Settlement of Strip Footings on a Strong Cohesionless Layer Overlying a Weak Deposit

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ABSTRACT

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In foundations and road engineering, it is quite often to encounter ground made of deep weak deposits. Structures built on this ground will experience low bearing capacity and excessive settlements. As an altemative to deep foundations and/or expensive soil improvement operation, especially in the case of highways and roads, replacing a limited thickness of this material by strong granular layer will increase the bearing capacity and reduce the settlements of these structures significantly.

The purpose of this study is to determine the reduction of the settlement of a strip footing on a weak deposit as a result of replacing the top layer immediately below the footing with a strong granular material. The parameters to be considered in this analysis are the initial strengths of the weak deposits as well as the artificially added top layer, the thickness of the top layer, width and depth of the footing, and level of loading.

The analysis will be conducted by means of finite element technique using the program CRISP which was developed by Cambridge University. The results are presented in the form of a parametric study to determine the effect of each of the above mentioned parameters on the settlement of these footings, and to determine the settlement components of the upper and lower layers and to establish the role of the upper layer to reduce the total settlement of these footings. A design chart will be presented to assist the practicing engineers in determining the contribution of the artificially added top layer in reducing the settlement of these footings.

DEDICATION

Dedicated to my Mother, my Father and my Sisters
their love was my source of energy.

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TABLE OF CONTENTS

	Page
LIST OF FIGURES	viii
LIST OF TABLES.	xii
LIST OF SYMBOLS	xxiii
CHAPTER 1	
INTRODUCTION	
1.1 General	1
1.2 Scope of the Thesis	2
CHAPTER 2	
LITERATURE REVIEW	
2.1 Background	4
2.2 Historical Development	6
2.3 Settlement of Foundation on Dense Sand Overlying a Weak Deposit	7
CHAPTER 3	
NUMERICAL MODELING	
3.1 General	9
3.2 Finite Element Model	9
3.3 Soil Model	12
3.4 Foundation Model.	12
3.5 Boundary Conditions .	12
3.6 Program "Crisp"	14
3.7 Ultimate and Working load	17

TABLE OF CONTENTS

	Page
3.7.1 Homogeneous soils	17
3.7.2 Layered soils	17
3.8 Variable Considered .	18
3.8.1 Modulus of Elasticity E.	18
3.8.2 Poisson Ratio μ1 μ2	19
3.8.3 Thickness of Upper Layer H	19
3.8.4 Width of Footing B	19

CHAPTER 4

RESULTA AND ANALYSIS

4.1 General .	20
4.2 Parametric Study	20
4.2.1 Effect of Modulus of Elasticity "E"	166
4.2.2 Effect of Possion Ratio μ	166
4.2.3 Effect of the Thickness of Upper Layer "H"	168
4.2.4 Effect of Width of Footing "B"	168
4.3 Settlement components	169
4.4 Design Charts	171

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion	175
5.2 Recommendation for Future Work	176
REFERENCES	177

LIST OF FIGURES

FIGURE	DESCRIPTION	page
1-1	Proplem Geometry of footing on a Dense Sand overlying a Weak Deposit.	3
2.1	Typical Load Versus Settlement Curves for Dense Sand , Loose Sand.	5
2.2	Typical Load Settlement Curves Buried Strip Footing in Dense Sand.Overlying Loose Sand. (Hanna 1981).	8
3.1	Finite Element Mesh of strip Footing on Homogeneous soil B=3.00m Layer Overlying a Weak Deposit.	11
3-2	Finite Element Mesh of Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m.	13
3-3	Undeformed / Deformed Mesh of Strip Footing on Homogeneous Soil B=3.00m.	15
3-4	Width / Length of Mesh Versus Settlement.	16
4-1	Test Results-Load Versus Settlement of Surface strip Footing on Homogeneous Dense Sand (B=3.00m).	145
4-2	Test Results-Load versus Settlement of Surface Strip Footing on Homogeneous Dense Sand (B=2.00m).	146
4-3	Test Results -Load versus settlement of surface Strip Footing on Homogeneous Dense Sand (B=1.00m).	147
4-4	Test Results -Load versus Settlement of Surface Strip Footing on Homogeneous Medium Sand (B=3.00m).	148
4-5	Test Results-Load Versus Settlement of Surface Strip Footing on Homogeneous Medium Sand (B=2.00m).	149

FIGURE	DESCRIPTION	page
4-6	Test Results -Load Versus Settlement of Surface strip Footing on Homogeneous Medium Sand(B=1.00m).	150
4-7	Test Results-Load Versus Settlement of Surface Strip Footing.on Homogeneous Loose Sand (B=3.00m).	151
4-8	Test Results-Load Versus Settlement of Surface Strip Footing on Homogeneous Loose Sand (B=2.00m).	152
4-9	Test Results -Load Versus Settlement of Surface Strip Footing on Homogeneous Loose Sand (B=1.00m).	153
4-10	Test Results -Load Versus Settlement of Surface Strip Footing on Dense Sand Overlying a Weak Deposit (B=3.00m).(GroupVII-Series c)	154
4-11	Test Results-Load Versus Settlement of Surface Strip Footing on Dense Sand Overlying a weak Deposit. (B=3.00m) (Group VII-Series d).	155
4-12	Test Results-Load Versus Settlement of Surfase Strip Footing.on a Dense Sand Overlying a Weak Deposit (B=3.00m).(Group VII-Series b).	156
4-13	Test Results-LoadVersus Settlement of SurfaceStrip Footing on a Dense Sand overlying a weak Deposit (B=3.00m) (GroupVII-Series a).	157
4-14	Test Results -Load Versus Settlement of Surface Strip Footing on a Dense Sand overlying a Weak Deposit. (B=3.00m).(Group VIII-Series a).	158

FIGURE	DESCRIPTION	page
4-15	Test Results-Load Versus Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit (B=3.00m).(Group VIII-Series b).	159
4-16	Test Results-Load Versus Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit (B=3.00m).(Group VIII-Series c).	160
4-17	Test Results -Load Versus Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit (B=3.00m).(Group VIII-Series d).	161
4-18	Test Results-Load Versus Settlement of Surface Strip Footingon a Dense Sand Overlying a Weak Deposit (B=3.00m).(Group IX-Series c).	162
4-19	Test Results-Load Versus Settlement of Surface Strip Footing on a Dense Sand overlying a weak deposit (B=3.00m).(Group IX -Series d).	163
4-20	Test Results-Load Versus Settlement of Surface Strip Footingon a Dense Sand Overlying a Weak Deposit (B=3.00m).(Group IX-Series a).	164
4-21	Test Results-Load Versus Settlemen' of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit. (B=3.00m).(Group IX-Series b).	165
4-22	Mouduls of Elasticity Versus Settlement of Strip Footing on Homogeneous Dense Sand B=3.00m.	167
4-23	Settlement Components Versus H/B,S_1,S_2 Upper, lower layers Respectivley.	170

FIGURE	DESCRIPTION	page
4-24	Reduction of Settlement of Strip Footing on a Dense Sand overlying a Weak Deposit.	172
4-25	Reduction of Settlement of Strip Footing on a Dense Sand overlying a Weak Deposit.	173
4-26	Reduction of Settlement of Strip Footing on a Dense Sand overlying a Weak Deposit.	174

List of Tabels

Table	DESCRIPTION	Page
4-1-a	Summary of The Testing Program for Surface Strip. Footingon Homogeneous Sand.	21
4-1-b	Summary of The Testing Program for Surface Strip Footing on a Dense Sand Overlying a Weak Deposit.	22
4-2	Test Results : Settlement of Surface Strip Footing on Homogeneous Dense Sand B=3.00m (Group I-Series 1).	28
4-3	Test Results: Settlement of Surface Strip Footing on Homogeneous Dense Sand B=2.00m (Group I-Series 2).	29
4-4	Test Results: Settlement of Surface Strip Footing on Homogeneous Dense Sand B=1.00m (Group I-Series 3).	30
4-5	Test Results: Settlement of Surface Strip Footing on Homogeneous Medium Sand B=3.00m (Group II-Series 1).	31
4-6	Test Results: Settlement of Surface Strip Footing on Homogeneous Medium Sand B=2.00m (Group II-Series 2).	32
4-7	Test Results: Settlement of Surface Strip Footing on Homogeneous Medium Sand B=1.00m (Group II-Series 3).	33
4-8	Test Results: Settlement of Surface Strip Footing on Homogeneous Loose Sand B=3.00m (Group III-Series 1).	34
4-9	Test Results: Settlement of Surface Strip Footing on Homogeneous Loose Sand B=2.00m (Group III-Series 2).	35
4-10	Test Results: Settlement of Surface Strip Footing on Homogeneous Loose Sand B=2.00m (Group III-Series 2)	36
4-11	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group IV-Series a).	37
4-12	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group IV-Series b).	38

Table	DESCRIPTION	Page
4-13	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group IV-Series c).	39
4-14	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group IV-Series d).	40
4-15	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group IV-Series e).	41
4-16	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group IV-Series f).	42
4-17	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group IV-Series g).	43
4-18	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group IV-Series h).	44
4-19	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group IV-Series i).	45
4-20	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group IV-Series j).	46
4-21	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group IV-Series k).	47
4-22	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group IV-Series l).	48
4-23	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group V-Series a).	49

Table	DESCRIPTION	Page
4-24	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group V-Series b).	50
4-25	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group V-Series c).	51
4-26	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group V-Series d).	52
4-27	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group V-Series e).	53
4-28	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group V-Series f).	54
4-29	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group V-Series g).	55
4-30	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group V-Series h).	56
4-31	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group V-Series i).(Group V-Series j).	57
4-32	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group V-Series k).(Group V-Series l).	58
4-33	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VI-Series a).	59
4-34	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VI-Series b).	60

Table	DESCRIPTION	Page
4-35	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VI-Series c).	61
4-36	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VI-Series d).	62
4-37	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group VI-Series e).(Group VI-Series f).	63
4-38	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group VI-Series g).(Group VI-Series h).	64
4-39	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group VI-Series i).(Group VI-Series j).	65
4-40	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (GroupVI-Series k).(Group VI-Series l).	66
4-41	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VII-Series a).	67
4-42	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VII-Series b).	68
4-43	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (GroupVII-Seriesc).	69
4-44	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VII-Series d).	70
4-45	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group VII-Series e).	71

Table	DESCRIPTION	Page
4-46	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group VII-Series f).	72
4-47	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group VII-Series g)	73
4-48	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group VII-Series h).	74
4-49	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group VII-Series i).	75
4-50	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group VII-Series j).	76
4-51	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group VII-Series k).	77
4-52	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group VII-Series l).	78
4-53	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VIII-Series a).	79
4-54	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VIII-Series b).	80
4-55	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VIII-Series c).	81
4-56	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (GroupVIII-Seriesd).	82

Table	DESCRIPTION	Page
4-57	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group VIII-Series e).	83
4-58	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group VIII-Series f).	84
4-59	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group VIII-Series g).	85
4-60	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group VIII-Series h).	86
4-61	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group VIII-Series i).(Group VIII-Series j).	87
4-62	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group VIII-Series k).(Group VIII-Series l).	88
4-63	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group IX-Series a).	89
4-64	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group IX-Series b).	90
4-65	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group IX-Series c).	91
4-66	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group IX-Series d).	92
4-67	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group IX-Series e).(Group IX-Series f).	93

Table	DESCRIPTION	Page
4-68	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group IX-Series e).(Group IX-Series f).	94
4-69	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group IX-Series i).(Group IX-Series j).	95
4-70	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group IX-Series k).(Group IX-Series l).	96
4-71	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group X-Series a).	97
4-72	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group X-Series b).	98
4-73	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group X-Series c).	99
4-74	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group X-Series d).	100
4-75	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group X-Series e).	101
4-76	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group X-Series f).	102
4-77	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group X-Series g).	103
4-78	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group X-Series h).	104

Table	DESCRIPTION	Page
4-79	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group X-Series i) (Group X-Series j).	105
4-80	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group X-Series k) (Group X-Series l).	106
4-81	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XI-Series a).	107
4-82	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XI-Series b).	108
4-83	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XI-Series c).	109
4-84	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XI-Series d).	110
4-85	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group XI-Series e).(Group XI-Series f).	111
4-86	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group XI-Series g).(Group XI-Series h).	112
4-87	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group XI-Series i).(Group XI-Series j).	113
4-88	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group XI-Series k).(Group XI-Series l).	114
4-89	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XII-Series a).	115

Table	DESCRIPTION	Page
4-90	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XII-Series b).	116
4-91	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XII-Series c).	117
4-92	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XII-Series d).	118
4-93	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group XII-Series e) (Group XII-Series f).	119
4-94	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group XII-Seriese g) (Group XII-Series h).	120
4-95	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group XII-Seriese i) (Group XII-Series j).	121
4-96	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group XII-Seriese k) (Group XII-Series l).	122
4-97	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XIII-Series a)	123
4-98	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XIII-Series b).	124
4-99	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XIII-Series c).	125
4-100	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XIII-Series d).	126

Table	DESCRIPTION	Page
4-101	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group XIII-Series e).(Group XIII-Series f).	127
4-102	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group XIII-Series g).(Group XIII-Series h).	128
4-103	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group XIII-Series i).(Group XIII-Series j).	129
4-104	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group XIII-Series k).(Group XIII-Series j).	130
4-105	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XIV-Series a).	131
4-106	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XIV-Series b).	132
4-107	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XIV-Series c).	133
4-108	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XIV-Series d).	134
4-109	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group XIV-Series e).(Group XIV-Series f).	135
4-110	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group XIV-Series g).(Group XIV-Seriesh).	136
4-111	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (GroupXIV-Series i).(GroupXIV-Series j).	137

Table	DESCRIPTION	Page
4-112	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group XIV-Seris k).(Group XIV-Series l).	138
4-113	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XV-Series a).(Group XV-Series b).	139
4-114	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XV-Series c).(Group XV-Series d).	140
4-115	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group XV-Series e).(Group XV-Series f).	141
4-116	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group XV-Series g).(Group XV-Series h).	142
4-117	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group XV-Series i).(Group XV-Series j).	143
4-118	Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group XV-Series k).(Group XV-Series l).	144

LIST OF SYMBOLS

SYMBOL	REPRESENTS
B	Width of Footing.
D	Depth of Footing.
H	Thickness of Upper Layer Below Footing Base
E	Modulus of Elasticity.
μ	Poisson Ratio.
q	Net Foundation Pressure.
Ec	Modulus of Elasticity of Concrete.
μ_c	Poisson Ratio of Concrete.
γ_c	Unit Weight of Concrete.
Ng . N_q . Nc	Bearing Capacity Factors.
Ks	Coefficient of Punching Shear Resistance.
μ_1	Poisson Ratio of Upper Layer.
μ_2	Poisson Ratio of Lower Layer.
γ_1	Unit Weight of the Upper Layer
γ_2	Unit Weight of the Lower Layer.
ϕ_1	Angle of Shearing Resistance of the Upper Layer.
ϕ_2	Angle of Shearing Resistance of the Lower Layer.
$N\gamma_1$, Nq_1	Bearing Capasity Factors for Homogeneous Upper Sand Layer.
$N\gamma_2$, Nq_2	Bearing Capacity Factors for Homogeneous Lower Sand Layer.
F_{cs} , F_{qs} , $F_{\gamma d}$	Shape Factors.
F_{ci} , F_{qi} , $F_{\gamma i}$	Load Inclination Factors.
F_{cd} , F_{qd}, $F_{\gamma d}$	Depth Factors.

SYMBOL	REPRESENTS
C	Cohesion of Soil.
γ	Unit Weight of Homogeneous Soil.
q_{ut} , q_u	Ultimate Bearing Capacity .
q_b	Ultimte Bearing Capacity of at Interface of two Layers Soil.
q_t	Ultimate Bearing Capacity of Footing in upper Sand Layer.
S_g	Settlement of Homogeneous Layers.
S_l	Total Settlement of Layer Soil under Base Foundation.
S1	Settlement Components of the Upper Layer Soil.
S2	Settlement Componenets of the Lower Layer Soil.

CHAPTER 1
INTRODUCTION

1.1 General

Structures impose stresses on the supporting soil causing deformations in the soil mass and settlement of these structures. In the design of foundations, two requirements must be satisfied. First the load must be sufficiently less than the ultimate bearing capacity of the foundation in order to ensure stability, the second is the total and differential settlement of the foundations must be small enough so that the superstructure will not be damaged by their movements. If the stability of the foundation is ensured with an adequate margin of safety, the design of foundations is governed largely by the requirement that the foundation movements must be within limits that can be tolerated by the superstructure. Thus, reliable and accurate methods for estimating foundation settlement are essential for the design of foundations.

The estimation of foundations settlement remains one of the unsolved geotechnical engineering problems, both from practical and theoretical points of view, especially for cohesionless soils. Settlement of soils may be defined as the vertical downward displacement of soils, or movement of structure on those soils brought about by a volume change in the soil due to a decrease in the volume of the voids in the soil. Settlement is due to the accumulation of particle rolling and slipping which results in a permanent soils skeleton change. Settlement is time dependent in case of cohesive soils and it takes place immediately in case of cohesionless soils.

Settlements of footings in homogeneous soils have been investigated by various researchers and several empirical methods have been developed to predict the settlement of these footings. However, no attempts were made to predict the

settlement of these footings if the ground was made of a limited thickness of dense sand overlying a weak deposit.

1.2 Scope of the Thesis

The objectives of this research program are:

a. To develop a numerical model to predict settlement of strip footing on a thin cohesionless soil layer overlying a weak deposit.

b. To examine this model against the available test data.

c. To conduct parametric study on the factors which affect the settlement of these footings.

d. To determine the settlement components of the upper and lower layers respectively, which make the total settlement of the foundation. Furthermore, to determine the role of the upper layer in reducing the total settlement of these footings.

e. To develop a design chart to be used by practicing engineers for predicting the contribution of the upper layer in reducing the total settlement of these footings.

In order to achieve the above mentioned objectives, finite element analysis will be conducted on a footing supported on a dense sand layer of depth H overlying a weak deposit (see figure 1-1).

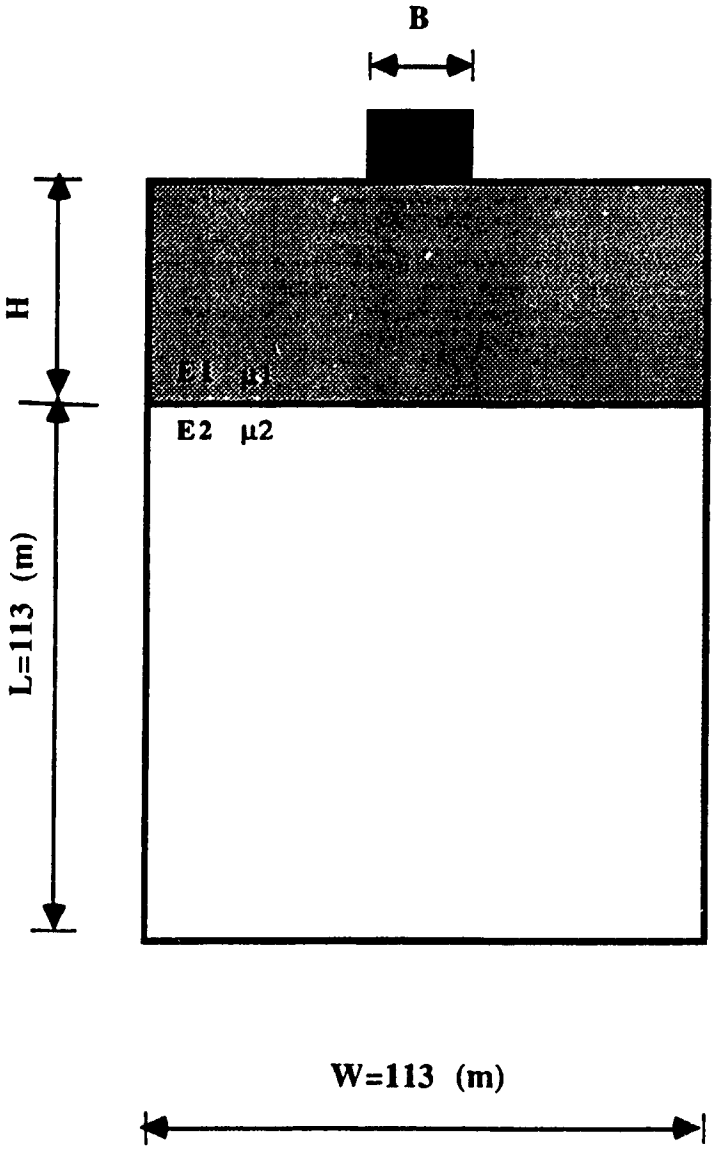


Figure (1-1) Problem Geometry of Footing on a Dense Sand Overlying a Weak Deposit

CHAPTER 2
LITERATURE REVIEW

2.1 Background

Settlements of foundation on sand take place immediately upon loading the foundation . The load settlement curve for this footing will possess a peak value for a dense sand case while no peak for the loose sand case (Hanna 1981), see figure 2-1.

In literature, several methods for predicting settlement of foundations on cohesionless soil were reported. Most of these methods are represented in the form of empirical formulas to correlate the results of standard penetrations tests or static - cone test to the settlement of these footings (Jorden 1977).

The discrepancies between these methods can be attributed to the many factors affecting this behavior which quite often are ignored or forgotten. Furthermore, it is difficult to obtain undisturbed sand for cohsionless soil which eliminates the use of laboratory testing in evaluating this settlement. In most of these methods the effects such as relative density, shape, mineralogy, grain size distribution, overburden pressure, water table level, in situ pressure were considered. Furthermore, these methods predict the settlement directly from the field measurement mentioned above or indirectly by correlating this field measurement to modulus of elasticity of this material. It should be mentioned here that these methods have only considered a limited thickness of the sand below the footing base as a representative for the homogeneous case (1B, 2B, ...etc.) (Schertmann 1970), furthermore, few of these methods have considered the case of variable modulus of elasticity with depth or the case of layer soils. It can be reported that these methods have failed to determine the interaction between these layers and

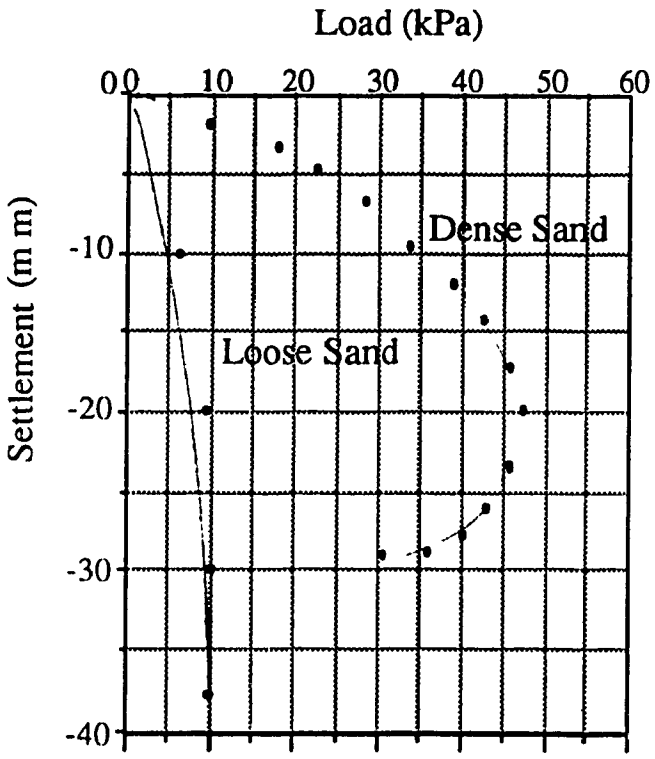


Figure (2-1) Typical Load- Settlement Curves
Footing on Homogeneous Dense, or Loose Sand
(Hanna 1981)

the energy consumed and accordingly the settlement contribution of each layer. The latter is the subject of the present investigation.

2.2 Historical Development

The available methods for estimating settlement of foundation on sand can be categorized as follows:

A. Methods based on field measurement:

Terzaghi's and Peck (1948) had developed an empirical formula to predict settlement of these footings based on the results of the standard penetration test. The method considered the sand below the footing as homogeneous i.e., the number of blows (N) values is constant with depth. They also introduced another formula to correlate this settlement with the result of the plate - load test. Alpan (1964), Meyerhof (1965), Gibbs and Holtz (1957), Peck and Bazaraa (1969), Peck (1974), have introduced similar formulas with modification to take into consideration the effect of overburden pressure and or the effect of water table level . The values predicted by these methods depend heavily on the accuracy of the field measurement.

B. Methods based on theory of elasticity:

DeBeer (1965), D'Appolonia et al. (1970), Schmertmann (1970), Parry (1971), and Hanna et al. (1993), have developed methods utilizing theory of elasticity to predict the settlement of these footings. The design parameters used in these methods are, modulus of elasticity and Poisson's ratio which can be determined either from laboratory test results or correlation with field data. Some of these methods have been considered as an advancement to the methods mentioned above; they have however, limited the depth below the footing base to a value equal to twice the foundation width regardless of the soil condition in site.

2.3 Settlement of Foundation on a Dense Sand Overlying a Weak Deposit:

This subject in literature has received little or no attention by the researchers. Some attempts were made to evaluate the settlement of each as an independent layer. Owies (1979), Enrico Conte and Giovanni Dente (1993). However the energy consumed in each layer, the interaction between layers, and the depth of influence below the footing base were not taken into consideration.

Some other methods such as Terzaghi (1948) have suggested to transfer the load of the footing entirely to the lower layer and proceed by calculating the settlement of the lower layer as described in Sections 2.2 A and B above. It should be made clear here that these methods ignore the contribution of the upper layer in reducing the total settlement of these footings.

It is of interest to know that Hanna (1981) has reported in his study for bearing capacity of footing on a dense sand layer overlying a weak deposit that although the bearing capacity for homogenous dense sand attained at higher thickness of the upper layer the deduced settlement remains greatly influenced by the existence of the lower weak layer. He also reported that the load settlement curve possessed a peak value at greater depth of the upper layer while no peak was observed for the lower values of H (See Figure 2-2).

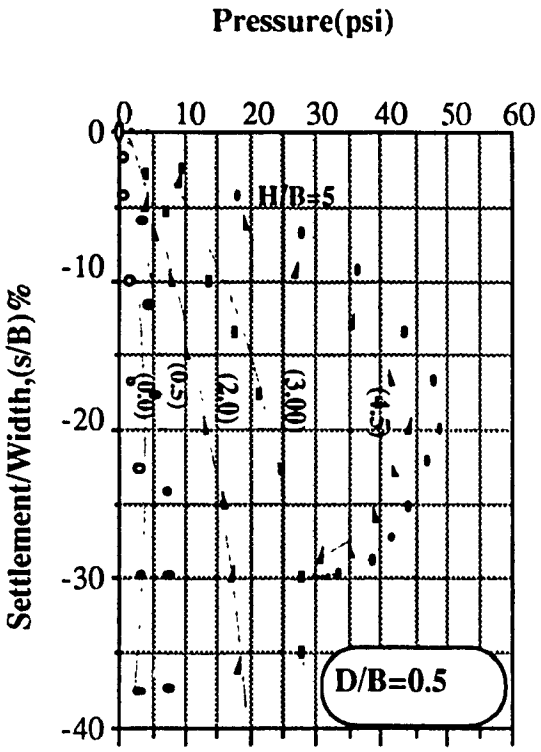


Figure (2-2) Typical Load Settlement Curves
Buried Strip Footings in a Dense Sand Overlying
Loose Sand (Hanna 1981) D : Depth of Footing

CHAPTER 3

NUMERICAL MODELING

3.1 General

Many problems in foundation engineering are concerned with stresses and deformation in the soil due to boundary and body forces. Theories of elasticity and plasticity have been widely used to solve these problems. However, due to computational difficulties, the number of these solutions remains limited even for cases in which stress-strain characteristics of the soil are ideal.

The finite element method combined with the availability of high-speed electronic computers made it feasible to perform this analysis for both linear and nonlinear stress-strain characteristics. Finite element method is known to be a powerful technique to solve varieties of science and engineering problems. It has become very popular in recent years in the field of geotechnical engineering to provide solutions to problems including foundations, dams, and earth retaining structures.

3.2 Finite Element Model

3.2.1. The following steps are usually taken in developing solutions by means of finite element technique.

a- Once the governing equation and boundary conditions, are established for the given problem, the appropriate finite element solution algorithm can be obtained.

b- Divide region under investigation into a number of elements. In two dimensional analysis areas may be divided up into triangles, rectangles,...etc.

c- Select interpolation function, as points within the elements (such as corners) to be designated as nodal points.

d- Determine element properties: Each element makes a contribution to the overall region which is a function of element geometry, material properties, number of nodal point, and other variables.

e- Element properties should be assembled to form a set of algebraic equations for the nodal values of the physical variables.

f- Solution of global equations if the global equations are linear (present investigation) many standard techniques are available to solve them.

g- Verification of solution: Three conditions must be satisfied in the theory of finite element analysis in order to develop the stiffness matrix equation, there are:

i- The deformation of adjacent element must be compatible.

ii- The forces acting on the element must be in equilibrium.

iii- The displacements of each element as a result of the applied forces must be consistent with physical properties of the material.

3.2.2 Finite Element Mesh: The choice of the number of element and mesh design has to reflect a compromise between an acceptable degree of accuracy and computing costs. The soil and foundation are modeled by the node quadrilateral element (non-coursol) LSQ variation of displacement using smaller element for the soil in the vicinity of the foundation (both in vertical and horizontal directions) where changes in the stress and strain are expected to be more significant. The total number of elements in the mesh are taken as 122 elements and the number of nodes are 148 for the homogeneous case. (See Figure 3-1). The total number of elements in the mesh for the layered system are taken as 133 elements and the number of nodes are 158 nodes. (See Figure 3-2).

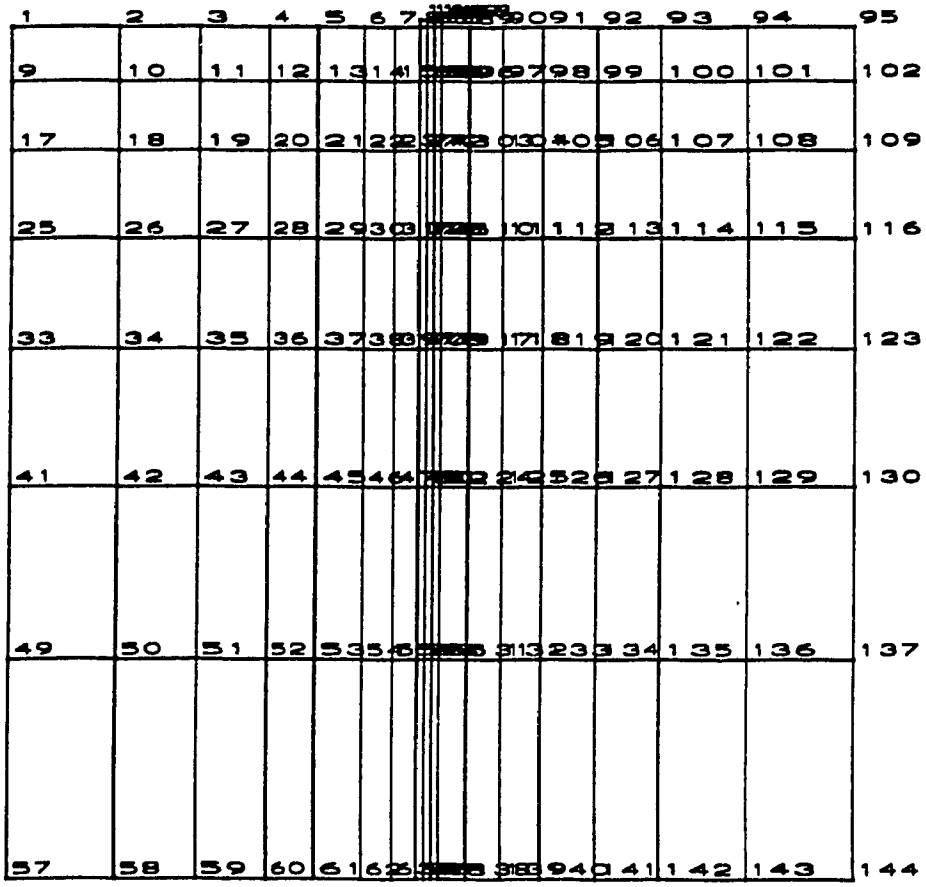


Figure (3-1) Finite Element Mesh of Strip Footing
on Homogeneous Soil B=3.00m

3.3. Soil Model

In developing the theoretical model the soil for each layer was considered as an elastic, homogeneous, isotropic and compressible. Soil mechanical properties are defined by the soil modulus (E) and Poisson's ratio (μ).

3.4 Foundation Model

Strip foundation model (plane strain condition) is completely rigid to simulate the case of reinforced concrete footing which will be loaded by uniformly distributed load (q). Contact surface between soil and foundation was considered as rough.

The foundation model, which is an impermeable elastic material with modulus of elasticity E_c = 1,000,000 kN/m^2, Poisson's ratio μ_c = 0.15 and the unit weight γ_c = 23kN/m^3. The width of the foundation was taken as 1.00 m, 2.00 m, and 3.00 m. The foundations were tested at the ground surface.

The value of the modulus of elasticity of the footings were taken high enough to simulate the rigidity of the concrete footings. This was based on the fact that the measured settlement at the center of the largest model was equivalent to the ones at the edge. This confirms that the settlement was uniform and accordingly the footings were rigid enough for the purpose of this investigation.

3.5 Boundary Conditions

The outer boundary should be placed as far away as possible from the region subjected to the largest change in the loading in order that no influence to the results will be reported. In designing the mesh the case of dense sand with low Possion's ratio were considered togther with the largest model footing size. This will constitute the worst condition and accordingly, the mesh will be suitable for all other cases to be considered in this investigation.

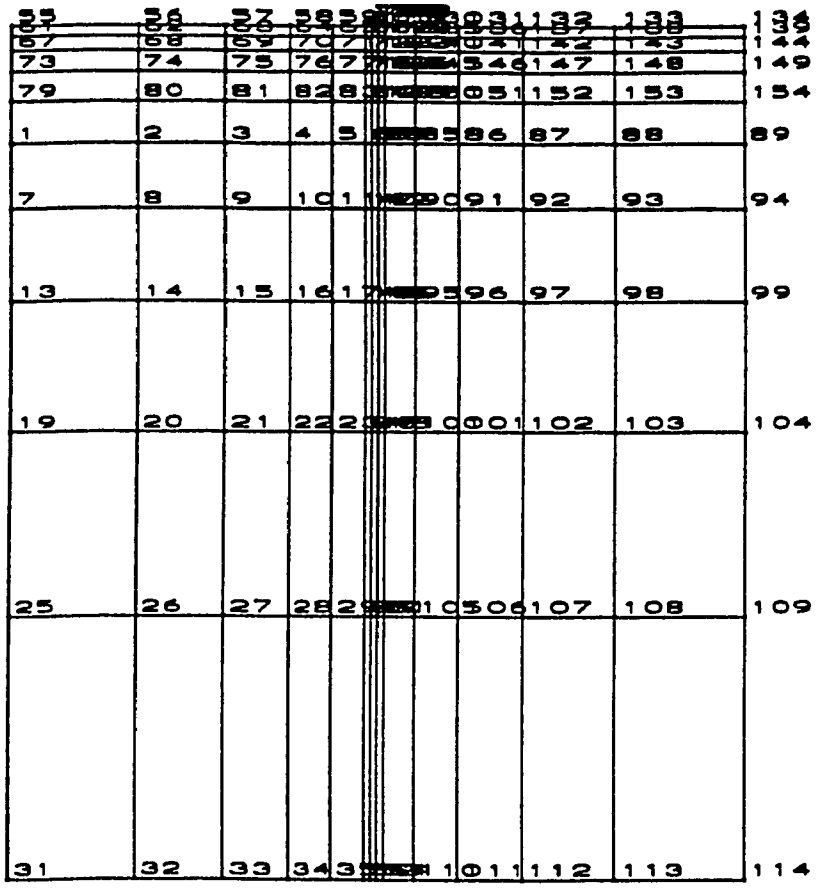


Figure (3-2) Finite Element Mesh of Strip Footing on a
Dense Sand Overlying a Weak Deposit B=3.00m

The nodes along the bottom boundary are considered as pinned supports (i.e., no movement is allowed in the both vertical and horizontal directions) whereas the nodes along the vertical boundary as rollers (i.e. no movement is allowed in a horizontal direction).

It is of interest to note that Enrico Conte and Giovani Dante (1993) have reported that the width of the mesh must be wide enough to avoid any mutual influence among the loaded areas. They reported a twenty time the loaded area usually provides satisfactory results for all practical purposes. Figure 3.3 shows no effect of length/width after 113 m which is considered our mesh and Figure 3.4 shows no boundary affecting the results.

3.6 Program "Crisp"

The program "CRISP" is capable of analyzing the undrained, drained or full consolidated of two or three dimensional analyses of solid bodies. The soil is considered anisotropic, elastic, homogeneous following critical state or elastic perfectly plastic models. The elements are linear strain triangle, cubic strain triangle, linear strain quadrilateral. The program takes into consideration the incremental approach options for updating nodal coordinates with progress of analysis.

The programs consist of "geometry program" and "main program", the input data which must be supplied to the program are:

1. information describing the finite element mesh, the coordinates of nodal points associated with each element. Based on this information , the program generates the node numbering system as shown in Figures 3-1 and 3-2 for homogeneous and layered soil, respectively.
2. material properties (and the situ stresses) associated with each finite element.
3. boundary condition of the region under investigation.

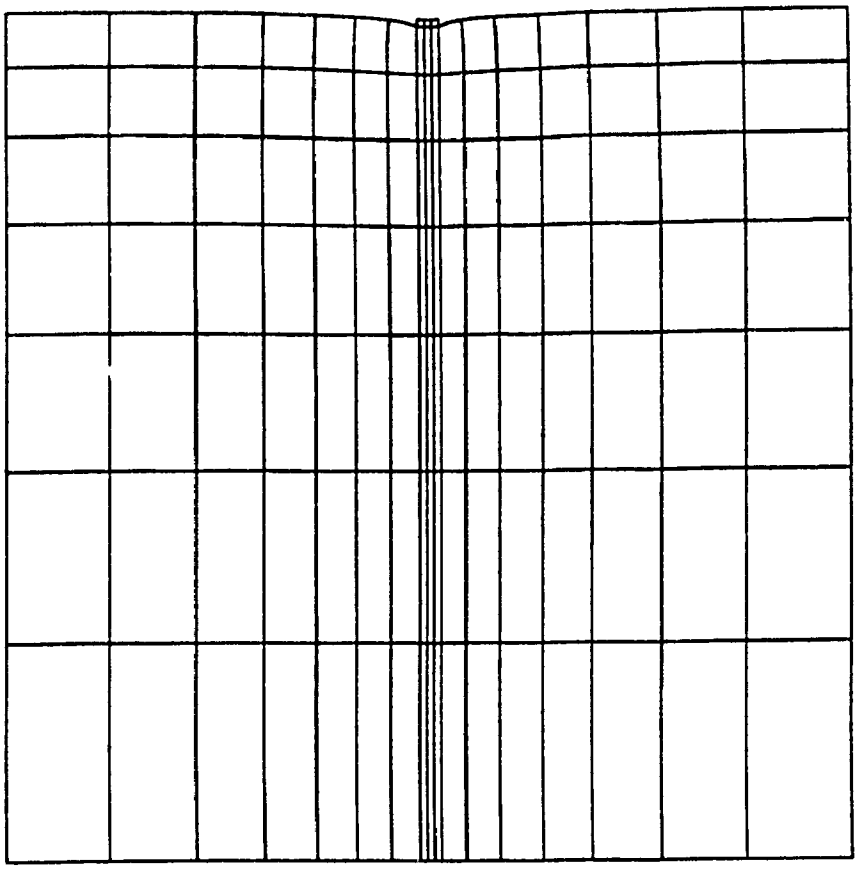


Figure (3-3) Undeformed/ Deformed Mesh of Strip Footing on Homogeneous Soil B=3.00m

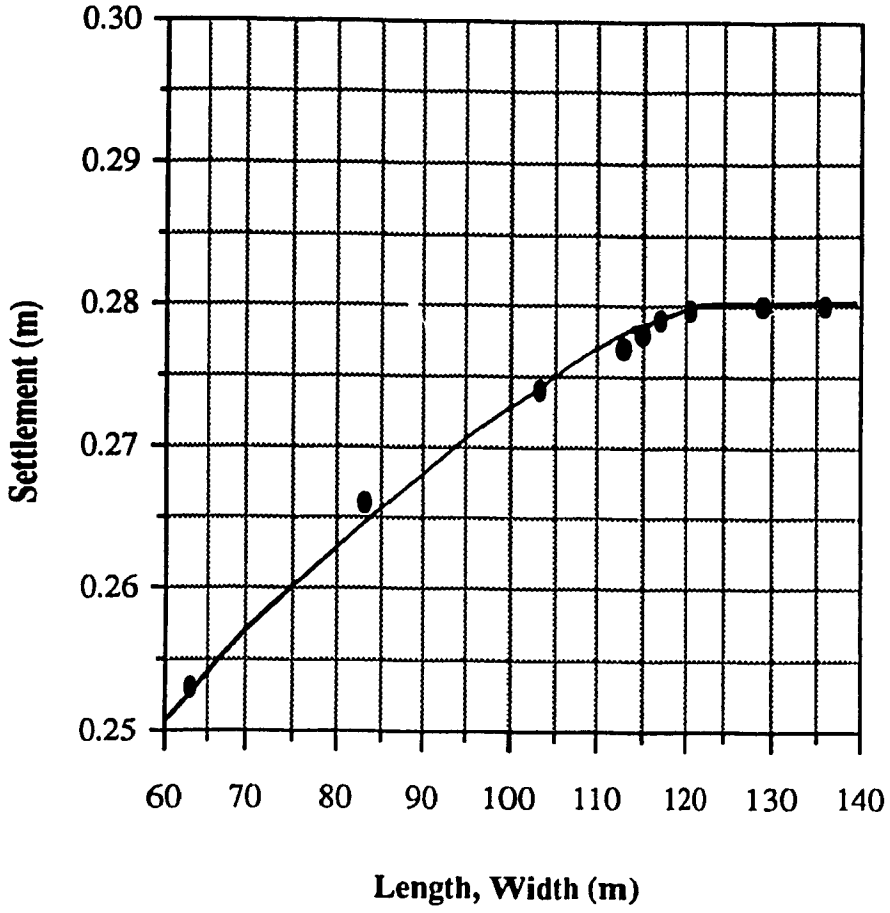


Figure (3-4) Width/Length of Mesh Versus Settlement

3.7 Ultimate and working load

In this investigation, the working load was taken in the range of one third to one half of the ultimate load.

3.7.1 Homogeneous soils:

The ultimate bearing capacity equation of a strip footing on homogeneous soil was used to determine the ultimate load on strip foundation models taken from *The Principles of Foundations, Engineering,* Das, M . B. and the equation suggested by Meyerhof (1963), thus:

$$q_u = CN_c F_{cs} F_{cd} F_{ci} + qN_q F_{qs} F_{qd} F_{qi} + \frac{1}{2}\gamma B N_\gamma F_{\gamma s} F_{\gamma d} F_{\gamma i} \qquad (3\text{-}1)$$

where N_C, N_q and N_γ are bearing capacity factors taken from Veric (1973); F_{cs}, F_{qs}, $F_{\gamma s}$, shape factors; F_{ci}, F_{qi}, $F_{\gamma i}$, load inclination factors; F_{cd}, F_{qd} $F_{\gamma d}$ depth factors; B width of the foundation , γ unit weight of the soil, C cohesion of soil, q effective stress at the level of the bottom of the foundation. Shape, depth and inclination factors are equal to one.

3.7.2 Layered soils:

The ultimate bearing capacity of a strip foundation on a dense layer overlying a weak deposit was determined using Hanna's theory (1981), thus

$$q_u = q_b + \gamma_1 H^2 (1 + \frac{2D}{H}) K_s tg\frac{\phi_1}{B} - \gamma_1 H \le q_t \qquad (3\text{-}2)$$

q_b is ultimate bearing capacity of footing at interface of two layered soil, H thickness of upper layer below footing base, K_S coefficient of punching shear resistance, γ_1 the unit weight of the upper layer soil, where ϕ_1 angle of shearing

resistance of the upper layer soil, D depth of the footing, q_t ultimate bearing capacity of footing in thick upper sand layer.

3.8 Variables Considered

The following parameters were isolated in order to determine their effects on the settlements of footings on homogeneous and layered soils:

3.8.1 Modulus of Elasticity E:

The following table summarizes the physical and mechanical characteristics of the sand in the present investigation:

Type of Sand	Modulus of Elasticity E kN/m^2	Poisson's Ratio μ	Unit Weight of Soil kN/m^3
dense sand	65000	0.3 to 0.45	21
	55000	0.3 to 0.45	21
	45000	0.3 to 0.45	20
medium sand	45000	0.3 to 0.45	19
	35000	0.25 to 0.4	18
	25000	0.2 to 0.4	17
	15000	0.2 to 0.4	17
loose sand	15000	0.2 to 0.4	16
	8000	0.2 to 0.4	16

Mechanical properties of the sand used in the present investigation were taken from Braj, M. Das (principles of foundation engineering, 1990).

3.8.2 Poisson's Ratio μ_1, μ_2

For the homogeneous soils Poisson's ratio was take in the range of 0.3 to 0.45 for dense and 0.2 to 0.45 for medium sand and 0.2 to 0.4 for loose sand. For layered soil, Poisson's ratio was taken according to the ranges mentioned above for each layer.

3.8.3 Thickness of upper layer H:

The thickness of the upper layer below the footing base was taken in between the extreme values, namely H = 0 for the case of homogeneous lower layer at H equal to a value at which the effect of the lower layer on the footing settlement was minimal.

3.8.4 Width of Footing B:

In order to study the effects of the footing width B on the deduced settlement, the model footing were taken as 1.00, 2.00, and 3.00 m.

CHAPTER 4
RESULTS AND ANALYSIS

4.1 General

In this investigation, 905 trial analyses were conducted using the numerical model described in Chapter Three. Out of these analyses, 216 were conducted to examine the parameters affecting the settlements of strip footings on homogeneous sands, and 689 analyses were conducted to examine the parameters affecting the settlement of these footings on a dense sand layer overlying a weak deposit. The testing program was divided into 15 groups, 3 groups for the case of homogeneous sand (see table 4.1.a) and the remaining 12 were for the case of layered soils (see table 4.1.b).

The study was tailored to isolate design parameters which are believed to have direct effect on the settlements of these footings. Tables (4-2) to (4-10) present the results for footings on homogeneous sand and Tables no. (4-11) to (4-118) present the results for these footings on layered soils. Figures (4-1) to (4-9) represent typical results of the calculated settlements versus the moudulus of elasticity for the case of a strip footing on homogeneous sands, and Figure (4-10) to (4-21) represent typical results for footings on a dense sand layer overlying a weak deposit. The experimental data of Hanna, 1981, were compared with the results of the present investigation. The comparisons are shown in Figures 4-2,4-24 for homogeneous and layer soils respectively.

4.2 Parametric Study

In this investigation the parameters affecting the settlements of these footings were isolated in order to determine their effects. These parameters are: the modulus of elasticity E, Possion's ratio μ, the width of the footing B, and the depth of the upper layer below the footing base H.

Table (4-1-a) Summary of The Testing Program for Surface Strip Footing on Homogeneous Sand

Group No	Series No	Number of Tests	Modulus of Elasticity $E(kN/m^2)$	Poisson Ratio μ	Width of Footing B (m)	Table No	Remark
I	1	24	45000-65000	0.30-0.45	3.00	(4-2)	Dense sand
	2	24	45000-65000	0.30-0.45	2.00	(4-3)	Dense sand
	3	24	45000-65000	0.30-0.45	1.00	(4-4)	Dense Sand
II	1	24	25000-45000	0.25-0.45	3.00	(4-5)	Medium Sand
	2	24	25000-45000	0.25-0.45	2.00	(4-6)	Medium sand
	3	24	25000-45000	0.25-0.45	1.00	(4-7)	Medium sand
III	1	24	8000-25000	0.20-0.40	3.00	(4-8)	Loose sand
	2	24	8000-25000	0.20-0.45	2.00	(4-9)	Loose Sand
	3	24	8000-25000	0.20-0.45	1.00	(4-10)	Loose sand

Table (4-1-b) Summary of The Testing Program for Surface Strip Footing on a Dense Sand Overlying a Weak Deposit

Group No	Series No	Number of Tests	Modulus of Elasticity E_1 (kN/m^2)	Modulus of Elasticity E_2 (kN/m^2)	E2/E1	Poisson Ratio $\mu 1$	Poissn Ratio $\mu 2$	Width of Footing (m)	Table No
IV	a	10	65000	8000	0.12	0.30	0.20	3.00	(4-11)
	b	10	65000	8000	0.12	0.45	0.20	3.00	(4-12)
	c	7	65000	8000	0.12	0.45	0.40	3.00	(4-13)
	d	7	65000	8000	0.12	0.30	0.40	3.00	(4-14)
	e	6	65000	8000	0.12	0.30	0.40	2.00	(4-15)
	f	6	65000	8000	0.12	0.45	0.40	2.00	(4-16)
	g	6	65000	8000	0.12	0.30	0.20	2.00	(4-17)
	h	6	65000	8000	0.12	0.45	0.20	2.00	(4-18)
	i	5	65000	8000	0.12	0.45	0.20	1.00	(4-19)
	j	5	65000	8000	0.12	0.30	0.20	1.00	(4-20)
	k	5	65000	8000	0.12	0.30	0.40	1.00	(4-21)
	l	5	65000	8000	0.12	0.45	0.40	1.00	(4-22)
V	a	6	65000	15000	0.23	0.30	0.40	3.00	(4-23)
	b	6	65000	15000	0.23	0.45	0.40	3.00	(4-24)
	c	6	65000	15000	0.23	0.45	0.20	3.00	(4-25)
	d	6	65000	15000	0.23	0.30	0.20	3.00	(4-26)
	e	5	65000	15000	0.23	0.30	0.40	2.00	(4-27)
	f	5	65000	15000	0.23	0.45	0.40	2.00	(4-28)
	g	5	65000	15000	0.23	0.45	0.20	2.00	(4-29)
	h	5	65000	15000	0.23	0.30	0.20	2.00	(4-30)
	i	4	65000	15000	0.23	0.45	0.40	1.00	(4-31)
	j	4	65000	15000	0.23	0.30	0.40	1.00	(4-31)
	k	4	65000	15000	0.23	0.30	0.20	1.00	(4-32)
	l	4	65000	15000	0.23	0.45	0.20	1.00	(4-32)

Continue Table (4-1.-b)::

Group No	Series No	Number of Tests	Modulus of Elasticity E_1 (kN/m^2)	Modulus of Elasticity E_2 (kN/m^2)	E2/E1	Poisson Ratio $\mu 1$	Poissn Ratio $\mu 2$	Width of Footing (m)	Table No
VI	a	6	65000	25000	0.38	0.30	0.40	3.00	(4-33)
	b	6	65000	25000	0.38	0.45	0.40	3.00	(4-34)
	c	6	65000	25000	0.38	0.30	0.20	3.00	(4-35)
	d	6	65000	25000	0.38	0.45	0.20	3.00	(4-36)
	e	4	65000	25000	0.38	0.30	0.20	2.00	(4-37)
	f	4	65000	25000	0.38	0.45	0.20	2.00	(4-37)
	g	4	65000	25000	0.38	0.30	0.40	2.00	(4-38)
	h	4	65000	25000	0.38	0.45	0.40	2.00	(4-38)
	i	3	65000	25000	0.38	0.45	0.20	1.00	(4-39)
	j	3	65000	25000	0.38	0.30	0.20	1.00	(4-39)
	k	3	65000	25000	0.38	0.30	0.40	1.00	(4-40)
	l	3	65000	25000	0.38	0.45	0.40	1.00	(4-40)
VII	a	10	55000	8000	0.15	0.45	0.20	3.00	(4-41)
	b	10	55000	8000	0.15	0.30	0.20	3.00	(4-42)
	c	7	55000	8000	0.15	0.30	0.40	3.00	(4-43)
	d	7	55000	8000	0.15	0.45	0.40	3.00	(4-44)
	e	6	55000	8000	0.15	0.30	0.40	2.00	(4-45)
	f	6	55000	8000	0.15	0.45	0.40	2.00	(4-46)
	g	6	55000	8000	0.15	0.30	0.20	2.00	(4-47)
	h	6	55000	8000	0.15	0.45	0.20	2.00	(4-48)
	i	5	55000	8000	0.15	0.30	0.40	1.00	(4-49)
	j	5	55000	8000	0.15	0.45	0.40	1.00	(4-50)
	k	5	55000	8000	0.15	0.30	0.20	1.00	(4-51)
	l	5	55000	8000	0.15	0.40	0.20	1.00	(4-52)

Continue Table (4-1.b))

Group No	Series No	Number of Tests	Modulus of Elasticity E_1 (kN/m^2)	Modulus of Elasticity E_2 (kN/m^2)	E2/E1	Poisson Ratio $\mu 1$	Poissn Ratio $\mu 2$	Width of Footing (m)	Table No
VIII	a	9	55000	15000	0.27	0.30	0.20	3.00	(4-53)
	b	9	55000	15000	0.27	0.45	0.20	3.00	(4-54)
	c	8	55000	15000	0.27	0.30	0.40	3.00	(4-55)
	d	7	55000	15000	0.27	0.45	0.40	3.00	(4-56)
	e	5	55000	15000	0.27	0.30	0.20	2.00	(4-57)
	f	5	55000	15000	0.27	0.45	0.20	2.00	(4-58)
	g	5	55000	15000	0.27	0.45	0.40	2.00	(4-59)
	h	5	55000	15000	0.27	0.30	0.40	2.00	(4-60)
	i	4	55000	15000	0.27	0.45	0.20	1.00	(4-61)
	j	4	55000	15000	0.27	0.30	0.20	1.00	(4-62)
	k	4	55000	15000	0.27	0.30	0.40	1.00	(4-62)
	l	4	55000	15000	0.27	0.45	0.40	1.00	(4-63)
IX	a	7	55000	25000	0.45	0.30	0.40	3.00	(4-63)
	b	7	55000	25000	0.45	0.45	0.40	3.00	(4-64)
	c	7	55000	25000	0.45	0.30	0.20	3.00	(4-65)
	d	7	55000	25000	0.45	0.45	0.20	3.00	(4-66)
	e	4	55000	25000	0.45	0.30	0.40	2.00	(4-67)
	f	4	55000	25000	0.45	0.45	0.40	2.00	(4-67)
	g	4	55000	25000	0.45	0.45	0.20	2.00	(4-68)
	h	4	55000	25000	0.45	0.30	0.20	2.00	(4-68)
	i	3	55000	25000	0.45	0.45	0.40	1.00	(4-69)
	j	3	55000	25000	0.45	0.30	0.40	1.00	(4-69)
	k	3	55000	25000	0.45	0.30	0.20	1.00	(4-70)
	l	3	55000	25000	0.45	0.45	0.20	1.00	(4-70)

Continue Table (4-1.b)::

Group No	Series No	Number of Tests	Modulus of Elasticity E_1 (kN/m^2)	Modulus of Elasticity E_2 (kN/m^2)	E2/E1	Poisson Ratio $\mu 1$	Poissn Ratio $\mu 2$	Width of Footing (m)	Table No
X	a	9	45000	8000	0.18	0.30	0.20	3.00	(4-71)
	b	9	45000	8000	0.18	0.45	0.20	3.00	(4-72)
	c	6	45000	8000	0.18	0.30	0.40	3.00	(4-73)
	d	6	45000	8000	0.18	0.45	0.40	3.00	(4-74)
	e	5	45000	8000	0.18	0.30	0.20	2.00	(4-75)
	f	5	45000	8000	0.18	0.45	0.20	2.00	(4-76)
	g	5	45000	8000	0.18	0.30	0.40	2.00	(4-77)
	h	5	45000	8000	0.18	0.45	0.40	2.00	(4-78)
	i	4	45000	8000	0.18	0.45	0.40	1.00	(4-78)
	j	4	45000	8000	0.18	0.30	0.40	1.00	(4-79)
	k	4	45000	8000	0.18	0.30	0.20	1.00	(4-80)
	l	4	45000	8000	0.18	0.45	0.20	1.00	(4-80)
XI	a	6	45000	15000	0.34	0.30	0.20	3.00	(4-81)
	b	6	45000	15000	0.34	0.45	0.20	3.00	(4-82)
	c	5	45000	15000	0.34	0.45	0.40	3.00	(4-83)
	d	5	45000	15000	0.34	0.30	0.40	3.00	(4-84)
	e	4	45000	15000	0.34	0.45	0.20	2.00	(4-85)
	f	4	45000	15000	0.34	0.30	0.20	2.00	(4-85)
	g	4	45000	15000	0.34	0.30	0.40	2.00	(4-86)
	h	4	45000	15000	0.34	0.45	0.40	2.00	(4-86)
	i	4	45000	15000	0.34	0.45	0.20	1.00	(4-87)
	j	4	45000	15000	0.34	0.30	0.20	1.00	(4-87)
	k	4	45000	15000	0.34	0.30	0.40	1.00	(4-88)
	l	4	45000	15000	0.34	0.45	0.40	1.00	(4-88)

Continue table (4-1.b)

Group No	Series No	Number of Tests	Modulus of Elasticity E_1 (kN/m^2)	Modulus of Elasticity E_2 (kN/m^2)	E2/E1	Poisson Ratio μ_1	Poisson Ratio μ_2	Width of Footing (m)	Table No
XII	a	5	45000	25000	0.56	0.45	0.20	3.00	(4-89)
	b	5	45000	25000	0.56	0.30	0.20	3.00	(4-90)
	c	5	45000	25000	0.56	0.45	0.40	3.00	(4-91)
	d	5	45000	25000	0.56	0.30	0.40	3.00	(4-92)
	e	4	45000	25000	0.56	0.45	0.40	2.00	(4-93)
	f	4	45000	25000	0.56	0.30	0.40	2.00	(4-93)
	g	4	45000	25000	0.56	0.30	0.20	2.00	(4-94)
	h	4	45000	25000	0.56	0.45	0.20	2.00	(4-94)
	i	3	45000	25000	0.56	0.45	0.20	1.00	(4-95)
	j	3	45000	25000	0.56	0.30	0.20	1.00	(4-95)
	k	3	45000	25000	0.56	0.30	0.40	1.00	(4-96)
	l	3	45000	25000	0.56	0.45	0.40	1.00	(4-96)
XIII	a	5	35000	8000	0.23	0.40	0.40	3.00	(4-97)
	b	5	35000	8000	0.23	0.25	0.40	3.00	(4-98)
	c	5	35000	8000	0.23	0.25	0.20	3.00	(4-99)
	d	5	35000	8000	0.23	0.40	0.20	3.00	(4-100)
	e	3	35000	8000	0.23	0.40	0.20	2.00	(4-101)
	f	3	35000	8000	0.23	0.25	0.20	2.00	(4-101)
	g	3	35000	8000	0.23	0.25	0.40	2.00	(4-102)
	h	3	35000	8000	0.23	0.40	0.40	2.00	(4-102)
	i	3	35000	8000	0.23	0.40	0.40	1.00	(4-103)
	j	3	35000	8000	0.23	0.25	0.40	1.00	(4-103)
	k	3	35000	8000	0.23	0.25	0.20	1.00	(4-104)
	l	3	35000	8000	0.23	0.40	0.20	1.00	(4-104)

Continue Table (4-1.-b):

Group No	Series No	Number of Tests	Modulus of Elasticity E_1 (kN/m^2)	Modulus of Elasticity E_2 (kN/m^2)	E2/E1	Poisson Ratio $\mu 1$	Poissn Ratio $\mu 2$	Width of Footing (m)	Table No
XIV	a	5	35000	15000	0.43	0.40	0.20	3.00	(4-105)
	b	5	35000	15000	0.43	0.25	0.20	3.00	(4-106)
	c	5	35000	15000	0.43	0.40	0.40	3.00	(4-107)
	d	5	35000	15000	0.43	0.25	0.40	3.00	(4-108)
	e	3	35000	15000	0.43	0.40	0.40	2.00	(4-109)
	f	3	35000	15000	0.43	0.25	0.40	2.00	(4-109)
	g	3	35000	15000	0.43	0.25	0.20	2.00	(4-110)
	h	3	35000	15000	0.43	0.40	0.20	2.00	(4-110)
	i	3	35000	15000	0.43	0.40	0.20	1.00	(4-111)
	j	3	35000	15000	0.43	0.25	0.20	1.00	(4-111)
	k	3	35000	15000	0.43	0.25	0.40	1.00	(4-112)
	l	3	35000	15000	0.43	0.40	0.40	1.00	(4-112)
XV	a	4	35000	25000	0.71	0.40	0.20	3.00	(4-113)
	b	4	35000	25000	0.71	0.25	0.20	3.00	(4-113)
	c	4	35000	25000	0.71	0.25	0.40	3.00	(4-114)
	d	4	35000	25000	0.71	0.40	0.40	3.00	(4-114)
	e	3	35000	25000	0.71	0.40	0.20	2.00	(4-115)
	f	3	35000	25000	0.71	0.25	0.20	2.00	(4-115)
	g	3	35000	25000	0.71	0.25	0.40	2.00	(4-116)
	h	3	35000	25000	0.71	0.40	0.20	2.00	(4-116)
	i	3	35000	25000	0.71	0.40	0.40	1.00	(4-117)
	j	3	35000	25000	0.71	0.25	0.40	1.00	(4-117)
	k	3	35000	25000	0.71	0.25	0.20	1.00	(4-118)
	l	3	35000	25000	0.71	0.40	0.20	1.00	(4-118)

Table (4-2) Test results : Settlement of Surface Strip Footing on Homogeneous Dense Sand B = 3.00 m (Group I- Series 1)

Test No	Modulus of Elasticity $E(kN/m^2)$	Poisson Ratio μ	Unit Weight γ (kN/m^3)	Angle of Friction ϕ (degree)	Ultimte Bearing Capacity (kN/m^2)	working Load (kN/m^2)	Settlement (m)
1	65000	0.30	21.00	45.00	8559	2000	-0.195
2	65000	0.30	21.00	45.00	8559	2500	-0.243
3	65000	0.30	21.00	45.00	8559	2853	-0.277
4	65000	0.45	21.00	45.00	8559	2000	-0.137
5	65000	0.45	21.00	45.00	8559	2500	-0.170
6	65000	0.45	21.00	45.00	8559	2853	-0.194
7	55000	0.30	21.00	45.00	8559	2500	-0.288
8	55000	0.30	21.00	45.00	8559	2853	-0.328
9	55000	0.30	21.00	45.00	8559	2900	-0.333
10	55000	0.45	21.00	45.00	8559	2500	-0.201
11	55000	0.45	21.00	45.00	8559	2853	-0.229
12	55000	0.45	21.00	45.00	8559	2900	-0.233
13	55000	0.30	20.00	42.00	4665	1400	-0.162
14	55000	0.30	20.00	42.00	4665	1555	-0.179
15	55000	0.30	20.00	42.00	4665	1700	-0.196
16	55000	0.45	20.00	42.00	4665	1400	-0.134
17	55000	0.45	20.00	42.00	4665	1555	-0.126
18	55000	0.45	20.00	42.00	4665	1700	-0.138
19	45000	0.30	20.00	42.00	4665	1400	-0.198
20	45000	0.30	20.00	42.00	4665	1555	-0.219
21	45000	0.30	20.00	42.00	4665	1700	-0.240
22	45000	0.45	20.00	42.00	4665	1400	-0.139
23	45000	0.45	20.00	42.00	4665	1555	-0.154
24	45000	0.45	20.00	42.00	4665	1700	-0.168

Table (4-3) Test Results : Settlement of Surface Strip Footing on Homogeneous Dense Sand B = 2.00 m (Group I - Series 2)

Test No	Modulus of Elasticity $E(kN/m^2)$	Poisson Ratio μ	Unit weight $\gamma (kN/m^3)$	Angle of Friction ϕ (degree)	Ultimte Bearing Capacity (kN/m2)	working Load (kN/m^2)	Settlement (m)
1	65000	0.30	21.00	45.00	5700	1800	-0.1224
2	65000	0.30	21.00	45.00	5700	1900	-0.129
3	65000	0.30	21.00	45.00	5700	2000	-0.136
4	65000	0.45	21.00	45.00	5700	1800	-0.087
5	65000	0.45	21.00	45.00	5700	1900	-0.092
6	65000	0.45	21.00	45.00	5700	2000	-0.096
7	55000	0.30	21.00	45.00	5700	1800	-0.145
8	55000	0.30	21.00	45.00	5700	1900	-0.152
9	55000	0.30	21.00	45.00	5700	2000	-0.161
10	55000	0.45	21.00	45.00	5700	1800	-0.103
11	55000	0.45	21.00	45.00	5700	1900	-0.108
12	55000	0.45	21.00	45.00	5700	2000	-0.114
13	55000	0.30	20.00	42.00	3111	900	-0.073
14	55000	0.30	20.00	42.00	3111	1037	-0.084
15	55000	0.30	20.00	42.00	3111	1100	-0.089
16	55000	0.45	20.00	42.00	3111	900	-0.052
17	55000	0.45	20.00	42.00	3111	1037	-0.059
18	55000	0.45	20.00	42.00	3111	1100	-0.063
19	45000	0.30	20.00	42.00	3111	900	-0.089
20	45000	0.30	20.00	42.00	3111	1037	-0.103
21	45000	0.30	20.00	42.00	3111	1100	-0.109
22	45000	0.45	20.00	42.00	3111	900	-0.063
23	45000	0.45	20.00	42.00	3111	1037	-0.073
24	45000	0.45	20.00	42.00	3111	1100	-0.077

Table (4-4) Test Results :.Settlement of Surface Strip Footing on Homogeneous Dense Sand B=1.00 m (Group I- series 3)

Test No	Modulus of Elasticity $E(kN/m^2)$	Poisson Ratio μ	Unit Weight γ (kN/m^3)	Angle of Friction ϕ (degree)	Ultimte Bearing Capacity (kN/m^2)	Working Load (kN/m^2)	Settlement (m)
1	65000	0.30	21.00	45.00	2853	800	-0.029
2	65000	0.30	21.00	45.00	2853	951	-0.034
3	65000	0.30	21.00	45.00	2853	1000	-0.036
4	65000	0.45	21.00	45.00	2853	800	-0.021
5	65000	0.45	21.00	45.00	2853	951	-0.025
6	65000	0.45	21.00	45.00	2853	1000	-0.026
7	55000	0.30	21.00	45.00	2853	800	-0.034
8	55000	0.30	21.00	45.00	2853	951	-0.041
9	55000	0.30	21.00	45.00	2853	1000	-0.043
10	55000	0.45	21.00	45.00	2853	800	-0.025
11	55000	0.45	21.00	45.00	2853	951	-0.029
12	55000	0.45	21.00	45.00	2853	1000	-0.031
13	55000	0.30	20.00	42.00	1560	400	-0.018
14	55000	0.30	20.00	42.00	1560	520	-0.023
15	55000	0.30	20.00	42.00	1560	600	-0.026
16	55000	0.45	20.00	42.00	1560	400	-0.013
17	55000	0.45	20.00	42.00	1560	520	-0.028
18	55000	0.45	20.00	42.00	1560	600	-0.019
19	45000	0.30	20.00	42.00	1560	400	-0.022
20	45000	0.30	20.00	42.00	1560	520	-0.028
21	45000	0.30	20.00	42.00	1560	600	-0.032
22	45000	0.45	20.00	42.00	1560	400	-0.016
23	45000	0.45	20.00	42.00	1560	520	-0.020
24	45000	0.45	20.00	42.00	1560	600	-0.023

Table (4-5) Test Results.: Settlement of Surfac Strip Footing on Homogeneous Medium Sand B = 3.00 m (Group II - Series 1)

Test No	Modulus of Elasitiity E(kN/m^2)	Poisson Ratio μ	Unit Weight γ (kN/m^3)	Ungle of Friction ϕ (degree)	Ultimte Bearing Capacity (kN/m2)	Working Load (kN/m^2)	Settlement (m)
1	45000	0.30	19.00	39.00	2628	600	-0.087
2	45000	0.30	19.00	39.00	2628	876	--0.125
3	45000	0.30	19.00	39.00	2628	900	-0.129
4	45000	0.45	19.00	39.00	2628	600	-0.061
5	45000	0.45	19.00	39.00	2628	878	-0.088
6	45000	0.45	19.00	39.00	2628	900	-0.090
7	35000	0.45	19.00	39.00	2628	600	-0.078-
8	35000	0.45	19.00	39.00	2628	878	-0.113
9	35000	0.45	19.00	39.00	2628	900	-0.116
10	35000	0.30	19.00	39.00	2628	600	-0.112
11	35000	0.30	19.00	39.00	2628	878	-0.165
12	35000	0.30	19.00	39.00	2628	900	-0.165
13	35000	0.25	18.00	36.00	1518	400	-0.079
14	35000	0.25	18.00	36.00	1518	506	-0.099
15	35000	0.25	18.00	36.00	1518	600	-0.118
16	35000	0.40	18.00	36.00	1518	400	-0.063
17	35000	0.40	18.00	36.00	1518	506	-0.079
18	35000	0.40	18.00	36.00	1518	600	-0.093
19	25000	0.40	18.00	36.00	1518	400	-0.088
20	25000	0.40	18.00	36.00	1518	506	-0.110
21	25000	0.40	18.00	36.00	1518	600	-0.129
22	25000	0.25	18.00	36.00	1518	400	-0.111
23	25000	0.25	18.00	36.00	1518	506	-0.139
24	25000	0.25	18.00	36.00	1518	600	-0.165

Table (4-6) Test results. : Settlement of Surface Strip Footing on Homogeneous Medium Sand B = 2.00 m (Group II -Series 2)

Test No	Modulus of Elasticity $E(kN/m^2)$	Poisson Ratio μ	Unitt weight $\gamma(kN/m^3)$	Angle of Friction ϕ (degree)	Ultimte Bearing Capacity (kN/m^2)	working Load (kN/m^2)	Settlement (m)
1	45000	0.30	19.00	39.00	1752	400	-0.041
2	45000	0.30	19.00	39.00	1752	584	-0.059
3	45000	0.30	19.00	39.00	1752	620	-0.062
4	45000	0.45	19.00	39.00	1752	400	-0.029
5	45000	0.45	19.00	39.00	1752	584	-0.042
6	45000	0.45	19.00	39.00	1752	620	-0.044
7	35000	0.30	19.00	39.00	1752	400	-0.053
8	35000	0.30	19.00	39.00	1752	584	-0.076
9	35000	0.30	19.00	39.00	1752	620	-0.080
10	35000	0.45	19.00	39.00	1752	400	-0.037
11	35000	0.45	19.00	39.00	1752	584	-0.054
12	35000	0.45	19.00	39.00	1752	620	-0.057
13	35000	0.25	18.00	36.00	1011	250	-0.036
14	35000	0.25	18.00	36.00	1011	337	-0.047
15	35000	0.25	18.00	36.00	1011	400	-0.056
16	35000	0.40	18.00	36.00	1011	250	-0.028
17	35000	0.40	18.00	36.00	1011	337	-0.037
18	35000	0.40	18.00	36.00	1011	400	-0.044
19	25000	0.40	18.00	36.00	1011	250	-0.039
20	25000	0.40	18.00	36.00	1011	337	-0.053
21	25000	0.40	18.00	36.00	1011	400	-0.062
22	25000	0.25	18.00	36.00	1011	250	-0.0501
23	25000	0.25	18.00	36.00	1011	337	-0.066
24	25000	0.25	18.00	36.00	1011	400	-0.078

Table (4-7) Test Results :.Settlement of Surface Strip Footing on Homogeneous Medium Sand B=1.00 m (Group II- Series 3)

Test No	Modulus of Elasticity $E(kN/m^2)$	Poisson Ratio μ	Unit Weight (kN/m^3)	Angle of friction ϕ (degree)	Ultimte Bearing Capacity (kN/m^2)	Working Load (kN/m^2)	Settlement (m)
1	45000	0.30	19.00	39.00	870	250	-0.014
2	45000	0.30	19.00	39.00	870	290	-0.016
3	45000	0.30	19.00	39.00	870	310	-0.017
4	45000	0.45	19.00	39.00	870	250	-0.010
5	45000	0.45	19.00	39.00	870	290	-0.011
6	45000	0.45	19.00	39.00	870	310	-0.012
7	35000	0.30	19.00	39.00	870	250	-0.018
8	35000	0.30	19.00	39.00	870	290	-0.021
9	35000	0.30	19.00	39.00	870	310	-0.022
10	35000	0.45	19.00	39.00	870	250	-0.013
11	35000	0.45	19.00	39.00	870	290	-0.015
12	35000	0.45	19.00	39.00	870	310	-0.016
13	35000	0.25	18.00	36.00	504	140	-0.011
14	35000	0.25	18.00	36.00	504	168	-0.013
15	35000	0.25	18.00	36.00	504	200	-0.015
16	35000	0.40	18.00	36.00	504	140	-0.009
17	35000	0.40	18.00	36.00	504	168	-0.011
18	35000	0.40	18.00	36.00	504	200	-0.0122
19	25000	0.40	18.00	36.00	504	140	-0.013
20	25000	0.40	18.00	36.00	504	168	-0.015
21	25000	0.40	18.00	36.00	504	200	-0.017
22	25000	0.25	18.00	36.00	504	140	-0.016
23	25000	0.25	18.00	36.00	504	168	-0.018
24	25000	0.25	18.00	36.00	504	200	-0.022

Table (4-8) Test Results : Settlement of Surface Strip Footing on Homogeneous Loose Sand B = 3.00 m (Group III -Series1)

Test No	Modulus of Elasticity E(kN/m^2)	Poisson Ratio μ	Unit Weight γ (kN/m^3)	Angle of Friction ϕ (degree)	Ultimte Bearing Capacity (kN/m2)	working Load (kN/m^2)	Settlement (m)
1	25000	0.20	17.00	33.00	900	200	-0.0611
2	25000	0.20	17.00	33.00	900	300	-0.089
3	25000	0.20	17.00	33.00	900	400	-0.1160
4	25000	0.40	17.00	33.00	900	200	-0.046
5	25000	0.40	17.00	33.00	900	300	-0.067
6	25000	0.40	17.00	33.00	900	400	-0.088
7	15000	0.40	17.00	33.00	900	200	-0.077
8	15000	0.40	17.00	33.00	900	300	-0.112
9	15000	0.40	17.00	33.00	900	400	-0.147
10	15000	0.20	17.00	33.00	900	200	-0.102
11	15000	0.20	17.00	33.00	900	300	-0.148
12	15000	0.20	17.00	33.00	900	400	-0.194
13	15000	0.20	16.00	30.00	540	160	-0.084
14	15000	0.20	16.00	30.00	540	180	-0.093
15	15000	0.20	16.00	30.00	540	200	-0.102
16	15000	0.40	16.00	30.00	540	160	-0.064
17	15000	0.40	16.00	30.00	540	180	-0.071
18	15000	0.40	16.00	30.00	540	200	-0.077
19	8000	0.40	16.00	30.00	540	160	-0.119
20	8000	0.40	16.00	30.00	540	180	-0.132
21	8000	0.40	16.00	30.00	540	200	-0.145
22	8000	0.20	16.00	30.00	540	160	-0.157
23	8000	0.20	16.00	30.00	540	180	-0.174
24	8000	0.20	16.00	30.00	540	200	-0.191

Table(4-9) Test Results : Settlement of Surface Strip Footing on Homogeneous Loose Sand B=2.00 m (Group III- Series 2)

Test No	Modulus of Elasticity E (kN/m^2)	Poisson Ratio μ	Unit Weight γ (kN/m^3)	Angle of Friction ϕ (degree)	Ultimte Dearing Capacity (kN/m^2)	working Load (kN/m^2)	Settlement (m)
1	25000	0.20	17.00	33.00	600	100	-0.0234
2	25000	0.20	17.00	33.00	600	200	-0.043
3	25000	0.20	17.00	33.00	600	300	-0.062
4	25000	0.40	17.00	33.00	600	100	-0.018
5	25000	0.40	17.00	33.00	600	200	-0.033
6	25000	0.40	17.00	33.00	600	300	-0.047
7	15000	0.40	17.00	33.00	600	100	-0.029
8	15000	0.40	17.00	33.00	600	200	-0.054
9	15000	0.40	17.00	33.00	600	300	-0.078
10	15000	0.20	17.00	33.00	600	100	-0.039
11	15000	0.20	17.00	33.00	600	200	-0.071
12	15000	0.20	17.00	33.00	600	300	-0.100
13	15000	0.20	16.00	30.00	360	90	-0.036
14	15000	0.20	16.00	30.00	360	120	-0.045
15	15000	0.20	16.00	30.00	360	150	-0.055
16	15000	0.40	16.00	30.00	360	90	-0.027
17	15000	0.40	16.00	30.00	360	120	-0.035
18	15000	0.40	16.00	30.00	360	150	-0.042
19	8000	0.40	16.00	30.00	360	90	-0.035
20	8000	0.40	16.00	30.00	360	120	-0.045
21	8000	0.40	16.00	30.00	360	150	-0.054
22	8000	0.20	16.00	30.00	360	90	-0.067
23	8000	0.20	16.00	30.00	360	120	-0.085
24	8000	0.20	16.00	30.00	360	150	-0.103

Table (4-10) Test Results :.Settlement of Surface strip Footing on Homogeneous Loose Sand B=1.00 m (Group III- Series 3)

Test No	Modulus of Elasticity $E(kN/m^2)$	Poisson Ratio μ	Unit Weight $\gamma(kN/m^3)$	Angle of Friction ϕ (degree)	Ultimte Bearing Capacity (kN/m^2)	working Load (kN/m^2)	Settlement (m)
1	25000	0.20	17.00	33.00	300	80	-0.010
2	25000	0.20	17.00	33.00	300	100	-0.012
3	25000	0.20	17.00	33.00	300	120	-0.014
4	25000	0.40	17.00	33.00	300	80	-0.008
5	25000	0.40	17.00	33.00	300	100	-0.0094
6	25000	0.40	17.00	33.00	300	120	-0.011
7	15000	0.40	17.00	33.00	300	80	-0.013
8	15000	0.40	17.00	33.00	300	100	-0.016
9	15000	0.40	17.00	33.00	300	120	-0.018
10	15000	0.20	17.00	33.00	300	80	-0.017
11	15000	0.20	17.00	33.00	300	100	-0.020
12	15000	0.20	17.00	33.00	300	120	-0.024
13	15000	0.20	16.00	30.00	180	30	-0.009
14	15000	0.20	16.00	30.00	180	60	-0.014
15	15000	0.20	16.00	30.00	180	80	-0.017
16	15000	0.40	16.00	30.00	180	30	-0.007
17	15000	0.40	16.00	30.00	180	60	-0.011
18	15000	0.40	16.00	30.00	180	80	-0.013
19	8000	0.40	16.00	30.00	180	30	-0.009
20	8000	0.40	16.00	30.00	180	60	-0.014
21	8000	0.40	16.00	30.00	180	80	-0.017
22	8000	0.20	16.00	30.00	180	30	-0.017
23	8000	0.20	16.00	30.00	180	60	-0.026
24	8000	0.20	16.00	30.00	180	80	-0.032

Table (4-11) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group IV- Series a)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (a)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	0	537	--	0.174	0.174	--	--	--	--	--	--	--		--	--	--	--
	2	3.00	1	2074	0.003	0.141	0.144	0.01	0.503	0.513	--	--	--	--		--	--	--	--
	3	6.00	2	4619	0.004	0.122	0.126	0.016	0.433	0.449	0.037	0.936	0.973	--		--	--	--	--
	4	9.00	3	7794	0.007	0.108	0.115	0.022	0.392	0.414	0.048	0.833	0.881	0.082	1.397	1.479	--	--	--
	5	12.00	4	11977	0.007	0.099	0.106	0.027	0.351	0.378	0.057	0.759	0.816	0.096	1.274	1.370	0.106	1.396	1.502
	6	15.00	5	11077	0.008	0.097	0.099	0.03	0.325	0.355	0.065	0.703	0.768	0.108	1.181	1.289	0.12	1.294	1.414
	7	18.00	6	11977	0.006	0.086	0.092	0.033	0.306	0.339	0.071	0.662	0.733	0.119	1.111	1.230	0.131	1.218	1.349
	8	21.00	7	11977	0.01	0.082	0.092	0.035	0.292	0.327	0.076	0.631	0.707	0.128	1.059	1.187	0.139	1.162	1.301
	9	24.00	8	11977	0.01	0.079	0.089	0.037	0.281	0.318	0.08	0.608	0.688	0.135	1.020	1.545	0.147	1.119	1.266

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.30	8000	0.20	0.123

Table (4-12) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group IV- Series b)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853kPa		
Series (b)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	0	537	--	0.174	0.174												
	2	3.00	1	2074	0.002	0.140	0.142	0.006	0.499	0.505	--	--	--	--	--	--	--	--	--
	3	6.00	2	4619	0.004	0.120	0.124	0.012	0.429	0.441	0.025	0.927	0.952	--	--	--	--	--	--
	4	9.00	3	7794	0.005	0.107	0.112	0.017	0.381	0.398	0.035	0.825	0.860	0.063	1.38	1.443	--	--	--
	5	12.00	4	11977	0.006	0.097	0.103	0.021	0.347	0.368	0.044	0.751	0.795	0.073	1.261	1.334	0.081	1.382	1.463
	6	15.00	5	11977	0.006	0.091	0.097	0.024	0.322	0.346	0.051	0.696	0.747	0.085	1.169	1.254	0.094	1.281	1.375
	7	18.00	6	11977	0.008	0.085	0.093	0.026	0.303	0.329	0.057	0.655	0.712	0.096	1.099	1.195	0.103	1.206	1.309
	8	21.00	7	11977	0.008	0.081	0.089	0.028	0.289	0.317	0.06	0.626	0.686	0.103	1.049	1.152	0.112	1.151	1.263
	9	24.00	8	11977	0.008	0.078	0.086	0.03	0.279	0.309	0.064	0.603	0.667	0.108	1.012	1.120	0.122	1.106	1.228

Soil Properties

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.45	8000	0.2	0.123

Table (4-13) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group IV- Series c)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (c)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		537	--	0.132	0.132	-	-	-	--	--	--	--	--	--	--	--	--
	2	3.00	1.00	2074	0.002	0.109	0.11	0.008	0.387	0.395	--	--	--	--	--	--	--	--	--
	3	9.00	3.00	7794	0.005	0.076	0.081	--	--	--	0.038	0.586	0.624	0.062	0.984	1.046			
	4	15.00	5.00	11977	.0067	.0587	.0654	--	--	--	0.102	0.452	0.554	--	--	--	0.096	0.831	0.927
	5	21.00	7.00	11977	0.008	0.049	0.057	--	--	--	-	-	-	0.103	0.631	0.734	0.113	0.692	0.805
	6	27.00	9.00	11977	.008	.044	.052	-	-	-	0.067	0.335	0.402	-	-	-	0.125	0.616	0.741
	7	30.00	10.00	11977	0.008	0.044	0.052	--	--	--	--	--	--	--	--	--	0.128	0.595	0.723

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.45	8000	0.4	0.123

Table (4-14) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VI- Series d)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (d)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1			537	--	0.132	0.132												
	2	3.00	1.00	2074	0.003	0.109	0.112	0.12	0.388	0.400	--	--	--	--	--	--	--	--	--
	3	9.00	3.00	7794	0.007	0.077	0.084	--	--	--	--	--	--	0.329	0.998	1.080	--	--	--
	4	15.00	5.00	11977	0.009	0.059	0.068	--	--	--	--	--	--	--	--	--	0.12	0.846	0.966
	5	21.00	7.00	11977	0.01	0.049	0.059	--	--	--	--	--	--	--	--	--	0.14	0.704	0.844
	6	27.00	9.00	11977	0.011	0.044	0.055	--	--	--	--	--	--	--	--	--	0.152	0.626	0.778
	7	30.00	10.00	11977	0.012	0.042	0.054	--	--	--	--	--	--	--	--	--	0.154	0.604	0.761

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.3	8000	0.4	0.123

Table (4-15) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group IV - Series e)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (e)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	360	-	0.093	0.093	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2115	.0024	.0749	.0773	0.008	0.267	0.275	-	-	-	-	-	-	-	-	-
	3	9.00	4.5	5706	.005	.052	.057	.008	.266	.274	-	-	-	.063	.673	.736	-	--	--
	4	15.00	7.5	5706	.0062	.034	.0400	.01	.263	.273	-	-	-	.064	.664	.728	0.09	0.567	0.657
	5	21.00	10.5	5706	.0074	.033	.0404	-	-	-	-	-		.067	.658	.725	0.101	0.471	0.572
	6	27.00	13.5	5706	.0075	.0295	.037	-	--	--	--	--	--	.069	.654	.723	0.11	0.417	0.527

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.3	8000	0.4	0.12

Table (4-16) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group IV - Series f)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (f)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	360	-	0.093	0.093	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2115	.001	.075	.076	0.004	0.267	0.271	-	-	-	-	-	-	-	-	-
	3	9.00	4.5	5706	.004	.051	.055	.004	.266	.270	-	-	-	.046	.665	.711	-	-	-
	4	15.00	7.5	5706	.005	.039	.044	.005	.264	.269	-	-	-	.047	.663	.710	0.071	0.557	0.628
	5	21.00	10.5	5706	.005	.033	.038	-	-	-	-	-	-	.048	.661	.709	0.082	0.462	0.544
	6	27.00	13.5	5706	-.003	.035	.038	-	-	-	-	-	-	-	-	-	0.09	0.411	0.501

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.45	8000	0.4	.012

Table (4-17) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group IV - Series g)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (g)	Test No	H (m)	H/B	q_{kz} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	360	-	0.121	0.121	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2115	.0022	.0963	.0985	0.008	0.343	0.351	-	-	-	-	-	-	-	-	-
	3	9.00	4.5	5706	.0048	.0731	.0775	0.008	0.342	0.350	-	-	-	.062	.949	1.001	-	-	-
	4	15.00	7.5	5706	.0063	.0611	.0674	0.009	0.340	0.349	-	-	-	.062	.938	1.00	0.089	0.866	0.955
	5	21.00	10.5	5706	.0072	.0547	.0819	-	-	--	-	-	-	--	--	--	0.102	0.775	0.[illegible]
	6	27.00	13.5	5706	.0077	.0512	.0589	-	-	-	-	-	-	-	-	-	0.109	0.726	0.835

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.3	8000	0.2	0.12

Table (4-18) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group IV - Series h)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (h)	Test No	H (m)	H/B	q_{ix} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		360	-	0.121	0.121	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2115	.0011	.0958	.0969	0.004	0.341	0.345	-	-	-	-	-	-	-	-	-
	3	9.00	4.5	5706	.0035	.072	.0755	0.005	0.339	0.344	-	-	-	.043	.932	.975	-	-	-
	4	15.00	7.5	5706	.005	.0604	.0654	0.006	0.336	0.342	-	-	-	.044	.930	.974	0.07	0.856	0.926
	5	21.00	10.5	5706	.0058	.0542	.0600	-	-	-	-	-	-	.045	.928	.973	0.083	0.767	0.850
	6	27.00	13.5	5706	.0064	.0508	.0572	-	-	-	-	-	-	-	-	-	0.09	0.719	0.809

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.45	8000	0.2	0.12

Table (4-19) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group IV - Series i)

Working Load (kPa)					180kPa			700kPa			1540kPa			2600kPa			2853kPa		
Series (i)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	180	-	.063	.063	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2598	.0004	.0491	.0495	0.003	0.174	0.177	-	-	-	-	-	-	-	-	-
	3	9.00	9.00	2853	.002	.036	.038	0.005	0.170	0.175	-	-	-	.025	.469	.494	-	-	-
	4	15.00	15.00	2853	.003	.03	.033	0.007	0.165	0.172	-	-	-	.022	.460	.482	.039	.429	.468
	5	21.00	21.00	2853	.0032	.0271	.0303	-	-	-	-	-	-	.018	.455	.473	.045	.384	.429

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.45	8000	0.2	0.12

Table (4-20) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group IV - Series j)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (j)	Test No	H (m)	H/B	q_{kz} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	180	-	.063	.063	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2598	.0012	.0493	.0505	0.004	0.175	0.179	-	-	-	-	-	-	-	-	-
	3	9.00	9.00	2853	.0024	.037	.0394	0.006	0.170	0.176	-	-	-	.036	.473	.509	-	-	-
	4	15.00	15.00	2853	.0036	.0306	.0342	0.009	0.166	0.175	-	-	-	.032	.470	.502	.05	.434	.484
	5	21.00	21.00	2853	.0039	.0274	.0313	-	-	-	-	-	-	.029	.468	.497	.055	.389	.444

Soil properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.3	8000	0.2	0.12

Table (4-21) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group IV - Series k)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (k)	Test No	H (m)	H/B	q_{kz} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	180	-	.049	.049	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2598	.0013	.0385	.0398	0.005	0.137	0.142	-	-	-	-	-	-	-	-	-
	3	9.00	9.00	2853	.0028	.027	.0298	0.007	0.134	0.141	-	-	-	.371	.339	.3761	-	-	-
	4	15.00	15.00	2853	.0035	.0201	.0236	0.009	0.130	0.139	-	-	-	.368	.335	.3718	.051	.284	.335
	5	21.00	21.00	2853	.004	.0166	.0206	-	-	-	-	-	-	.365	.330	.3665	.057	.235	.292

Soil Properties:

E_1kN/m^2	μ_1	E_2kN/m^2	μ_2	E_2/E_1
65000	0.3	8000	0.4	0.12

Table (4-22) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group IV - Series I)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (I)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	180	-	.049	.049	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	3.0	2598	.008	.0385	.0393	0.002	0.137	0.139	-	-	-		-	-	-	-	-
	3	9.00	9.0	2853	.002	.026	.028	0.002	0.134	0.136	-	-	-	.026	.336	.362	-	-	-
	4	15.00	15.0	2853	.0028	.0197	.0225	0.003	0.132	0.135	-	-	-	.028	.334	.362	.04	.279	.319
	5	21.00	21.0	2853	.0033	.0163	.0196	-	-	-	-	-	-	.030	.330	.36	.046	.231	.277

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.45	8000	0.4	0.12

Table (4-23) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group V- Series a)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (a)	Test	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		537	-	0.071	0.071	--	--	--	--	--	--	--	--	--	--	--	--
	2	3.00	1.00	2074	.0032	.0608	0.064	.0012	0.216	0.228	--	--	--	--	--	--	--	--	--
	3	9.00	3.00	7794	.0066	.0444	0.051	--	--	--	--	--	--	0.084	0.575	0.659	--	--	--
	4	12.00	4.00	11977	.0079	.039	.0469	--	--	--	0.059	0.302	0.361	--	--	--	0.109	0.556	0.665
	5	18.00	6.00	11977	.0092	0.032	.0412	--	--	--	0.073	0.245	0.318	--	--	--	0.132	0.452	0.584
	6	24.00	8.00	11977	0.01	0.027	0.037	--	--	--	0.081	0.21	0.291	--	--	--	0.132	0.452	0.584

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.3	15000	0.4	0.23

Table (4-24) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group V- Series b)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (b)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		537	-	.071	0.71	--	--	--	--	--	--	--	--	--	--	--	--
	2	3.00	1.00	2074	0.002	0.061	0.063	.007	0.216	0.223	--	--	--	--	--	--	--	--	--
	3	9.00	3.00	7794	.0006	.0442	.0488	--	--	--	--	--	--	0.06	0.571	0.631	--	--	--
	4	12.00	4.00	11977	.007	0.038	.0045	--	--	--				--	--	--	0.082	0.550	0.632
	5	18.00	6.00	11977	0.008	0.031	0.039	--	--	--	0.057	0.242	0.299	--	--	--	0.104	0.446	0.550
	6	24.00	8.00	11977	.0081	.0269	0.035	--	--	--	--	--	--	--	--	--	0.119	0.381	0.500

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.45	15000	0.4	0.23

Table (4-25) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group V- Series c)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (c)	Test No.	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		537	--	0.093	0.093	--	--	--	--	--	--	--	--	--	--	--	--
	2	3.00	1.00	2074	0.001	0.078	0.079	0.005	0.277	0.286	--	--	--	--	--	--	--	--	--
	3	9.00	3.00	7794	0.004	0.061	0.065	--	--	--	0.034	0.466	0.500	0.057	0.782	0.839	--	--	--
	4	12.00	4.00	11977	0.006	0.055	0.061	--	--	--				0.072	0.715	0.787	0.079	0.784	0.863
	5	18.00	6.00	11977	--	--	--	0.026	0.172	0.198	0.056	0.372	0.428				0.103	0.684	0.787
	6	24.00	8.00	11977	--	--	--	0.03	0.157	0.187	0.065	0.339	0.404	0.108	0.569	0.677	0.119	0.624	0.743

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.45	15000	0.2	0.23

Table (4-26) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group V- Series d)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (d)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		537	--	0.092	0.092	--	--	--	--	--	--	--	--	--	--	--	--
	2	3.00	1.00	2074	0.002	0.078	0.081	0.01	0.279	0.289	0.022	0.603	0.625	--	--	--	--	--	--
	3	9.00	3.00	7794	.0064	.0609	.0673	0.023	0.216	0.239	0.049	0.469	0.518	0.082	0.787	0.869	--	--	--
	4	12.00	4.00	11977	.0073	0.055	0.061	0.027	0.198	0.226	0.058	0.429	0.487	0.099	0.719	0.818	0.108	0.789	0.897
	5	18.00	6.00	11977	.0094	.048	.058	0.034	0.172	0.198	0.072	0.372	0.428	0.12	0.629	0.749	0.133	0.689	0.822
	6	24.00	8.00	11977	.011	.044	.055	0.037	0.157	0.187	0.081	0.339	0.404	0.108	0.569	0.677	0.149	0.629	0.778

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.30	15000	0.2	0.23

Table (4-27) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group V - Series e)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (e)	Test No	H (m)	H/B	q_u kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	360	-	0.049	0.049	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2115	.0025	.0419	.0444	0.009	0.149	0.158	-	-	-	-	-	-	-	-	-
	3	9.00	4.5	5706	.0049	.0301	.0350	0.01	0.146	0.156	-	-	-	.065	.388	.453	-	-	-
	4	15.00	7.5	5706	.0064	.0235	.0299	-	-	-	-	-	-	.066	.386	.452	0.091	0.333	0.424
	5	21.00	10.5	5706	.0073	.0196	.0269	-	-	-	-	-	-	-	-	-	.103	0.277	0.380

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.3	15000	0.4	0.23

Table (4-28) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group V - Series f)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (f)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	360	-	0.049	.049	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2115	.0014	.0419	.0433	0.005	0.149	0.154	-	-	-	-	-	-	-	-	-
	3	9.00	4.5	5706	.0035	.0299	.0334	0.006	0.148	0.152	-	-	-	.046	.386	.432	-	-	-
	4	15.00	7.5	5706	.005	.0232	.0282	-	-	-	-	-	-	.048	.382	.430	.071	0.329	0.400
	5	21.00	10.5	5706	.0058	.0193	.0251	-	-	-	-	-	-	-	-	-	0.083	0.273	0.356

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.45	15000	0.4	0.23

Table (4-29) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group V - Series g)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (g)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		360	-	0.064	0.064	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2115	.0014	.053	.0544	0.004	0.190	0.194	-	-	-	-	-	-	-	-	-
	3	9.00	4.5	5706	.003	.041	.044	.006	.186	.192	-	-	-	.043	.527	.570	-	-	-
	4	15.00	7.5	5706	.0048	.0344	.0392	.008	.180	.188	-	-	-	.044	.525	.569	0.069	0.487	0.556
	5	21.00	10.5	5706	.0058	.0306	.0364	-	-	-	-	-	-	.040	.523	.568	.082	0.434	0.516

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.45	15000	0.2	0.23

Table (4-30) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group V - Series h)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (h)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	360	-	.064	.064	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2115	.0022	.0536	.0558	0.007	0.191	0.198	-	-	-	-	-	-	-	-	-
	3	9.00	4.5	5706	.005	.041	.046	0.008	0.188	0.196	-	-	-	.064	.529	.593	-	-	-
	4	15.00	7.5	5706	.007	.034	.041	0.009	0.186	0.195	-	-	-	.067	.523	.590	0.09	0.491	0.581
	5	21.00	10.5	5706	.007	.031	.038	-	-	-	-	-	-	.07	.518	.588	0.103	0.438	0.541

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.30	15000	0.2	0.23

Table (4-31) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group V - Series i)(Group V - Series j)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (i & j)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
(i)	1	0	-	180	-	.026	.026	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2598	.0007	.0217	.0224	0.002	0.077	0.079	-	-	-	-	-	-	-	-	-
	3	9.00	9.00	2853	.002	.0151	.0171	0.004	0.075	0.079	-	-	-	.049	.194	.243	-	-	-
	4	15.00	15.00	2853	.0028	.0117	.0145	-	-	-	-	-	-	.054	.191	.245	.04	.165	.205
(j)	1	0	-	180	-	.026	.026	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2598	.001	.022	.023	0.005	0.077	0.082	-	-	-	-	-	-	-	-	-
	3	9.00	9.00	2853	.003	.015	.018	0.007	0.073	0.08	-	-	-	.037	.196	.233	-	-	-
	4	15.00	15.00	2853	.004	.011	.015	-	-	-	-	-	-	.039	.194	.233	.051	.167	.218

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.45	15000	0.4	0.23
65000	0.3	15000	0.4	0.23

Table (4-32) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.oom (Group V - Series k)(Group V - Series l)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (k & l	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
(k)	1	0	-	180	-	.034	.034	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2598	.001	.028	.029	0.005	0.098	0.103	-	-	-	-	-	-	-	-	-
	3	9.00	9.00	2853	.002	.024	.026	0.007	0.094	0.101	-	-	-	.036	.303	.339	-	-	-
	4	15.00	15.00	2853	.004	.017	.021	-	-	-	-	-	-	.33	.300	.333	.05	.246	.296
(l)	1	0	-	180	-	.034	.034	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2598	.001	.027	.028	0.002	0.097	0.099	-	-	-	-	-	-	-	-	-
	3	9.00	9.00	2853	.002	.023	.025	0.004	0.093	0.097	-	-	-	.025	.301	.326	-	-	-
	4	15.00	15.00	2853	.002	.017	.019	-	-	-	-	-	-	.021	.29	.311	.039	.244	283

soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.30	15000	0.20	0.23
65000	0.45	15000	0.20	0.23

Table (4-33) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VI- Series a)

Working Load (kPa)					300 kPa			972 kPa			1940 kPa			2853kPa		
Series (a)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		972	--	0.067	0.067	--	--	--	--	--	--	--	--	--
	2	3.00	1.00	2918	0.006	0.059	0.065	0.015	0.184	0.199	--	--	--	--	--	--
	3	9.00	3.00	8711	0.01	0.045	0.055	--	--	--	0.065	0.272	0.337	0.095	0.399	0.494
	4	12.00	4.00	8711	.0162	.0398	0.052	0.039	0.122	0.161	--	--	--	0.11	0.354	0.465
	5	15.00	5.00	8711	0.014	0.358	.0498	--	--	--	0.084	0.218	0.302	0.126	0.319	0.443
	6	18.00	6.00	8711	.0152	.0326	.0478	0.046	0.104	0.147	--	--	--	0.135	0.291	.426

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.30	25000	0.4	0.38

Table (4-34) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VI- Series b)

Working Load (kPa)					800 kPa			972 kPa			1940 kPa			2853 kPa		
Series (b)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		972	--	0.067	0.067	--	--	--	--	--	--	--	--	--
	2	3.00	1.00	2918	.0028	.0597	.0625	0.009	0.184	0.193	--	--	--	--	--	--
	3	9.00	3.00	8711	0.007	0.045	0.052	0.024	0.137	0.161	--	--	--	0.065	0.399	0.464
	4	12.00	4.00	8711	.0091	.0397	.0488	--	--	--	0.055	0.241	0.296	0.082	0.253	0.435
	6	15.00	5.00	8711	0.01	0.036	0.046	--	--	--	0.064	0.217	0.281	0.095	0.317	0..412
	6	18.00	6.00	8711	0.012	0.032	0.044	--	--	--	0.071	0.197	0.268	0.105	0.288	0.393

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.45	25000	0.4	0.38

Table (4-35) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VI- Series c)

Working Load (kPa)					300 kPa			972 kPa			1940 kPa			2853 kPa		
Series (c)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		972	--	0.088	0.088	--	--	--	--	--	--	--	--	--
	2	3.00	1.00	2918	0.005	0.077	0.082	0.014	0.237	0.251	--	--	--	--	--	--
	3	9.00	3.00	8711	0.01	0.061	0.071	--	--	--	0.065	0.368	0.431	0.093	0.539	0.632
	4	12.00	4.00	8711	0.013	0.055	0.068	0.038	0.171	0.209	--	--	--	0.11	0.494	.604
	5	15.00	5.00	8711	0.013	0.052	0.065	--	--	--	0.084	0.314	0.398	0.124	0.459	0.583
	6	18.00	6.00	8711	0.016	0.048	0.064	0.047	0.149	0.196	--	--	--	0.15	0.433	0.567

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.3	25000	0.2	0.38

Table (4-36) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VI- Series d)

Working Load (kPa)					300 kPa			972 kPa			1940 kPa			2853 kPa		
Series (d)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		972	--	0.088	0.088	--	--	--	--	--	--	--	--	--
	2	3.00	1.00	2918	0.002	0.077	0.079	0.006	0.236	0.242	--	--	--	--	--	--
	3	9.00	3.00	8711	.0067	.0603	0.067	0.021	0.186	0.207	--	--	--	0.062	0.537	0.599
	4	12.00	4.00	8711	0.009	0.055	0.064	--	--	--	0.053	0.336	0.389	0.079	0.492	0.571
	5	15.00	5.00	8711	.0104	.0514	.0618	0.032	0.158	0.190	--	--	--	0.092	0.457	0.549
	6	18.00	6.00	8711	.0107	0.483	0.059	--	--	--	0.09	0.294	0.384	0.103	0.430	0.533

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.45	25000	0.2	0.38

Table (4-37) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group VI - Series e) (Group VI - Series f)

Working Load (kPa)					300 kPa			972 kPa			1940 kPa			2853 kPa		
Series (e & f)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
(e)	1	0	-	600	-	0.062	.062	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2841	.032	.0526	.0558	0.011	0.163	0.174	-	-	-	-	-	-
	3	9.00	4.5	5706	.0079	.0408	.0487	0.01	0.160	0.170	-	-	-	.071	.363	.434
	4	15.00	7.5	5706	.0122	.0345	.0467	-	-	-	-	-	-	.091	.307	.398
(f)	1	0		600	-	0.062	.062	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2841	.0016	.0525	.0541	0.005	0.162	0.167	-	-	-	-	-	-
	3	9.00	4.5	5706	.0053	.0407	.0460	0.006	0.158	0.164	-	-	-	.047	.362	.409
	4	15.00	7.5	5706	.0078	.0343	.0421	-	-	-	-	-	-	.069	.306	.375

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.3	25000	0.2	0.38
65000	0.45	25000	0.2	0.38

Table (4-38) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group VI - Series g) (Group VI - Series h)

Working Load (kPa)					300 kPa			972 kPa			1940 kPa			2853 kPa		
Series (g & h	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
(g)	1	0	-	600		.047	.047	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2841	.004	.0413	.0453	0.012	0.127	.139	-	-	-	-	-	-
	3	9.00	4.5	5706	.0081	.0303	.0384	0.015	0.121	.136	-	-	-	.072	.270	.342
	4	15.00	7.5	5706	.01	.024	.034	-	-	-	-	-	-	.092	.214	.306
(h)	1	0		600	-	.047	.047	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2841	.0021	.0414	.0435	0.007	0.127	0.134	-	-	-	-	-	-
	3	9.00	4.5	5706	.0055	.0304	.0359	0.009	0.122	0.131	-	-	-	.0489	.271	.3199
	4	15.00	7.5	5706	.0079	.0239	.0318	-	-	-	-	-	-	.07	.213	.283

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.3	25000	0.4	0.38
65000	0.45	25000	0.4	0.38

Table (4-39) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group VI - Series i) (Group VI - Series j)

Working Load (kPa)					300kPa			972 kPa			1940 kPa			2853 kPa		
Series (i & j)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
(i)	1	0	-	300	-	.032	.032	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2853	.001	.027	.028	.003	.083	.086	-	-	-	-	.-	-
	3	9.00	9.00	2853	.003	.021	.024	.005	.080	.0855	-	-	-	.028	.183	.211
(j)	1	0	-	300	-	.032	.032	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2853	.002	.027	.029	.007	.084	.091	-	-	-	-	.-	-
	3	9.00	9.00	2853	.004	.021	.025	.009	.031	.09	-	-	-	.041	.183	.224

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.45	25000	0.2	0.38
65000	0.4	25000	0.2	0.38

Table (4-40) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group VI - Series k)(Group VI - Series l)

Working Load(kPa)					300 kPa			972 kPa			1940 kPa			2853 kPa		
Series (k&l)	Test No	H (m)	H/B	q_{ut} kN/m	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
(k)	1	0	-	300	-	.025	.025	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2853	.003	.021	.024	.008	.066	.074	-	-	-	-	-	-
	3	9.00	9.00	2853	.0049	.015	.0199	.009	.064	.073	-	-	-	.041	.137	.178
(l)	1	0	-	300	-	.025	.025	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2853	.0012	.0215	.0227	.003	.066	.069	-	-	-	-	-	-
	3	9.00	9.00	2853	.0036	.015	.0186	.005	.063	.068	-	-	-	.029	.137	.166

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
65000	0.3	25000	0.4	0.38
65000	0.45	25000	0.4	0.38

Table (4-41) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VII- Series a)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (a)	Test No.	H (m)	H/B	qut kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		537	--	0.174	0.174	--	--	--	--	--	--	--	--	--	--	--	--
	2	3.00	1.00	2074	0.002	0.141	0.143	0.006	0.505	0.511	--	--	--	--	--	--	--	--	--
	3	6.00	2.00	4619	0.004	0.122	0.129	0.013	0.435	0.448	0.029	0.940	0.969	--	--	--	--	--	--
	4	9.00	3.00	7794	0.006	0.108	0.114	0.02	0.387	0.407	0.042	0.837	0.879	0.004	1.466	1.475	--	--	--
	5	12.00	4.00	11977	0.007	0.099	0.106	0.027	0.35	0.377	0.051	0.764	0.815	0.088	1.281	1.369	0.095	1.405	1.500
	6	15.00	5.00	11977	0.071	0.092	0.099	0.028	0.327	0.355	υ.06	0.708	0.768	0.101	1.188	1.289	0.111	1.303	1.414
	7	18.00	6.00	11977	0.009	0.086	0.095	0.031	0.308	0.339	0.087	0.666	0.733	0.118	1.112	1.23	0.02	1.23	1.25
	8	21.00	7.00	11977	0.01	0.082	0.092	0.035	0.294	0.327	0.072	0.635	0.707	0.114	1.066	1.18	0.132	1.168	1.300
	9	24.00	8.00	11977	0.01	0.079	.0.089	0.037	0.283	0.318	0.079	0.611	0..687	0.126	1.026	1.154	0.14	1.125	1.265

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.45	8000	0.2	0.15

Table (4-42) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VII- Series b)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (b)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		537	--	0.174	0.174	--	--	--	--	--	--	--	--	--	--	--	--
	2	3.00	1 00	2074	0.003	0.143	0.146	0.013	0.507	0.520	--	--	--	--	--	--	--	--	--
	3	6.00	2.00	4619	0.006	0.123	0.129	0.021	0.438	0.459	0.044	0.948	0.992	--	--	--	--	--	--
	4	9.00	3.00	7794	0.008	0.109	0.117	0.027	0.391	0.418	0.058	0.845	0.903	0.097	1.418	1.515	--	--	--
	5	12.00	4.00	11977	0.009	0.100	0.109	0.031	0.357	0.388	0.068	0.771	0.839	0.116	1.294	1.41	0.122	1.418	1.544
	6	15.00	5.00	11977	0.01	0.093	0.103	0.035	0.331	0.366	0.077	0.715	0.792	0.029	1.200	1.229	0.142	1.316	1.458
	7	18 00	6.00	11977	0.011	0.087	0.098	0.039	0.311	0.350	0 084	0.673	0.757	0.141	1.129	1.270	0.155	1.238	1.393
	8	21.00	7.00	11977	.0116	.0832	.0948	0.042	0.296	0.338	0 09	0.641	0.731	0.151	1.075	1.226	0.165	1.179	1.344
	9	24.00	8.00	11977	.0121	.0758	.0879	0.044	0.285	0.329	0.154	0.617	0.711	0.159	1.035	1.194	0.173	1.135	1.308

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.3	8000	0.2	0.15

Table (4-43) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VII- Series c)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (c)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		537	--	0.174	0.174	--	--	--	--	--	--	--	--	--	--	--	--
	2	3.00	1.00	2074	0.003	0.110	0.113	0.009	0.392	0.472	--	--	--	--	--	--	--	--	--
	3	9.00	3.00	4619	0.008	0.079	0.087	--	--	--	--	--	--	0.09	1.02	1.11	--	--	--
	4	15.00	5.00	7794	.011	.0.061	.072	--	--	--	--	--	--	--	--	--	0.143	0.869	1.012
	5	21.00	7.00	.0095	0.012	0.051	0.061	--	--	--	--	--	--	--	--	--	0.166	0.723	0.889
	6	27.00	9.00	11977	0.013	0.045	0.0558	--	--	--	--	--	--	--	--	--	0.182	0.639	0.821
	7	30.00	10.00	11977	0.014	0.043	0.057	--	--	--	--	--	--	--	--	--	0.187	0.616	0.803

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.3	8000	0.4	0.15

Table (4-44) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VII- Series d)

Working Load (kPa)					180 kPa			700 kPa			1540kPa			2600 kPa			2853 kPa		
Series (d)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		537	--	0.174	0.174	--	--	--	--	--	--	--	--	--	--	--	--
	2	3.00	1.00	2074	0.003	0.110	0.113	0.009	0.392	0.401	--	--	--	--	--	--	--	--	--
	3	9.00	3.00	4619	0.006	0.078	0.084	--	--	--	0.049	0.599	0.694	0.074	1.006	1.080	--	--	--
	4	15.00	5.00	7794	0.008	.0609	.0683	--	--	--	0.061	0.465	0.526	--	--	--	0.113	0.855	0.968
	5	21.00	7.00	11977	.0095	0.501	.0596	--	--	--	--	--	--	0.121	0.649	0.770	0.134	0 711	0.845
	6	27.00	9.00	11977	0.01	0.045	0.055	--	--	--	0.08	0.342	0.422	--	--	--	0.147	0.630	0.777
	7	30.00	10.00	11977	0.01	0.043	0.053	--	--	--	--	--	--	--	--	--	0.151	0.607	0.758

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.45	8000	0.4	0.15

Table (4-45) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group VII - Series e)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (e)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	360	-	.093	.093	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2115	.0029	.0759	.0788	0.011	0.270	0.281	-	-	-	-	-	-	-	-	-
	3	9.00	4.5	5706	.0057	.0533	.0590	0.029	0.25	0.279	-	-	-	.075	.688	.763	-	-	-
	4	15.00	7.5	5706	.0077	.0411	.0488	0.031	0.23	0.261	-	-	-	.077	.683	.760	0.106	0.583	0.689
	5	21.00	10.5	5706	.0085	.0341	.0426	-	-	-	-	-	-	.079	.679	.758	0.121	0.483	0.604
	6	27.00	13.5	5706	.0092	.0301	.0393	-	-	-	-	-	-	-	-	-	0.13	0.427	0.557

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.3	8000	0.4	0.15

Table (4-46) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group VII - Series f)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (f)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	360	-	.093	.093	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2115	.0013	.0757	.077	0.007	0.269	0.276	-	-	-	-	-	-	-	-	-
	3	9.00	4.5	5706	.0042	.0526	.0568	0.009	0.264	0.273	-	-	-	.054	.681	.735	-	-	-
	4	15.00	7.5	5706	.0059	.0405	.0464	0.011	0.260	0.271	-	-	-	.056	.674	.730	0.083	0.574	0.657
	5	21.00	10.5	5706	.0069	.0335	.0404	-	-	-	-	-	-	.058	.671	.729	0.098	0.475	0.573
	6	27.00	13.5	5706	.0076	.0296	.0372	-	-	-	-	-	-	-	-	-	0.108	0.419	0.527

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.45	8000	0.4	0.15

Table (4-47) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group VII - Series g)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (g)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	360	-	.121	.121	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2115	.003	.0097	.100	0.009	0.347	0.356	-	-	-	-	-	-	-	-	-
	3	9.00	4.5	5706	.0057	.0738	.0795	0.01	0.340	0.350	-	-	-	.073	.954	1.027	-	-	-
	4	15.00	7.5	5706	.0075	.0621	.0696	0.012	0.336	0.348	-	-	-	.075	.931	1.006	0.106	0.880	0.986
	5	21.00	10.5	5706	.0085	.0556	.0641	-	-	-	-	-	-	.072	.928	1.00	0.121	0.787	0.908
	6	27.00	13.5	5706	.0093	.0518	.0611	-	-	-	-	-	-	-	-	-	0.131	0.734	0.865

Soil Properties;

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1	B (m)
55000	0.3	8000	0.2	0.15	2.00

Table (4-48) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group VII - Series h)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (h)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	360	-	.121	.121	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2115	.001	.0097	.098	0.004	0.345	0.349	-	-	-	-	-	-	-	-	-
	3	9.00	4.5	5706	.004	.073	.077	0.005	0.340	0.345	-	-	-	.051	.946	.997	-	-	-
	4	15.00	7.5	5706	.0058	.0615	.0673	0.007	0.336	0.343	-	-	-	.053	.940	.993	0.082	0.872	0.954
	5	21.00	10.5	5706	.0068	.0551	.0619	0.009	0.330	0.339	-	-	-	.055	.936	.991	0.098	0.779	0.877
	6	27.00	13.5	5706	.0075	.0514	.0589	-	-	-	-	-	-	-	-	-	0.107	0.728	0.835

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.45	8000	0.2	0.15

Table (4-49) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group VII - Series I)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (I)	Test No	H (m)	H/B	qut kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	180	-	0.049	0.049	-			-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2598	.003	.039	.041	0.006	0.139	0.145	-	-	-	-	-	-	-	-	-
	3	9.00	9.00	2853	.003	.027	.031	.008	.136	.144	-	-	-	.044	.347	.391	-	-	-
	4	15.00	15.00	2853	.004	.021	.025	.01	.133	.143	-	-	-	.041	.344	.385	.06	.292	.352
	5	21.00	21.00	2853	.004	.017	.022	-	-	-	-	-	-	.039	.340	.379	.067	.241	.308

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.3	8000	0.4	0.15

Table (4-50) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group VII-SeriesJ)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (j)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	180	-	0.048	0.048	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2598	.002	.049	.051	0.002	0.177	0.179	-	-	-	-	-	-	-	-	-
	3	9.00	9.00	2853	.002	.037	.039	.004	.173	.177	-	-	-	.029	.477	.506	-	-	-
	4	15.00	15.00	2853	.003	.031	.034	.006	.170	.176	-	-	-	.030	.472	.502	.046	.437	.483
	5	21.00	21.00	2853	.005	.026	.031	-	-	-	-	-	-	.033	.465	.498	.055	.389	.444

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.45	8000	0.4	0.15

Table (4-51) Test Results: Settlement of Surface Strip Footing
on a Dense Sand Overlying a Weak Deposit B=1.00m
(Group VII - Series K)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (k)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	180	-	.063	.063	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2598	.001	.050	.051	0.005	0.178	0.183	-	-	-	-	-	-	-	-	-
	3	9.00	9.00	2853	.004	.037	.041	.007	.175	.182	-	-	-	.042	.481	.523	-	-	-
	4	15.00	15.00	2853	.004	.031	.035	.009	.173	.182	-	-	-	.043	.475	.518	.06	.441	.501
	5	21.00	21.00	2853	.004	.028	.032	-	-	-	-	-	-	.044	.471	.515	.066	.394	.460

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.3	8000	0.2	0.15

Table (4-52) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group VII - Series I)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (I)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	180	-	0.063	0.063	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2598	.001	.039	.040	0.004	0.139	0.143	-	-	-	-	-	-	-	-	-
	3	9.00	9.00	2853	.006	.025	.031	.006	.136	.142	-	-	-	.031	.344	.375	-	-	-
	4	15.00	15.00	2853	.003	.021	.024	.007	.133	.140	-	-	-	.028	.341	.369	.047	.288	.335
	5	21.00	10.5	11977	.004	.017	.021	-	-	-	-	-	-	-	-	-	.055	.237	.292

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.4	8000	0.2	0.15

Table (4-53) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VIII- Series a)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (a)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		537	--	0.093	0.093	--	--	--	--	--	--	--	--	--	--	--	--
	2	3.00	1.00	2074	0.004	0.079	0.083	0.012	0.282	0.294	--	--	--	--	--	--	--	--	--
	3	6.00	2.00	4619	0.006	0.069	0.075	0.022	0.245	0.267	0.045	0.530	0.575	--	--	--	--	--	--
	4	9.00	3.00	7794	.0074	0.062	.0694	0.28	0.219	0.247	0.059	0.475	0.534	0.099	0.797	0.896	--	--	--
	5	12.00	4.00	11977	.0091	.0565	.0656	--	--	--	0.07	0.435	0.505	0.118	0 729	0 847	0.129	0.800	0 929
	6	15.00	5.00	11977	.0102	.0525	.0627	0.036	0.187	0.223	--	--	--	0.132	0.678	0 810	0.144	0 744	0.888
	7	18.00	6.00	11977	.0111	.0494	.0605	--	--	--	0 086	0.380	0 466	0.144	0 638	0.782	0 158	0.699	0 857
	8	21.00	7.00	11977	0.012	.0469	.0589	0.042	0.167	0.209	--	--	--	0 153	0.607	0.780	0.168	0.665	0.833
	9	24.00	8.00	11977	--	--	--	0.045	0.160	0.205	--	--	--	0.161	0.582	0.743	0.177	0.638	0.815

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.30	15000	0.2	0.27

Table (4-54) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VIII- Series b)

Working Load (kPa)					180 kPa			700 kPa			1539 kPa			2600 kPa			2853 kPa		
Series (b)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		537	--	0.093	0.093	--	--	--	--	--	--	--	--	--	--	--	--
	2	3.00	1.00	2074	0.002	0.078	0.080	0.007	0.279	0.286	-	--	--	--	--	--	--	--	--
	3	6.00	2.00	4619	0.004	0.068	0.072	0.012	0.244	0.256	0.028	0.527	0.555	--	--	--	--	--	--
	4	9.00	3.00	7794	.0056	0.061	.066	--	--	--	0.041	0.472	0.513	0.068	0.793	0.861	--	--	--
	5	12.00	4.00	11977	0.007	0.056	0.063	0.025	0.199	0.224	--	--	--	0.084	0.726	0.811	0.093	0.796	0.889
	6	15.00	5.00	11977	0.007	0.052	0.059	--	--	--	0.006	0.401	0.461	0.1	0.674	0.774	0.109	0.739	0.888
	7	18.00	6.00	11977	0.008	0.049	0.057	0.03	0.175	0.205	--	--	--	0.106	0.634	0.745	0.122	0.695	0.817
	8	21.00	7.00	11977	--	--	--	0.033	0.166	0.199	--	--	--	--	--	--	0.133	0.660	0.793
	9	24.00	8.00	11977	--	--	--	0.035	0.159	0.194	0.076	0.344	0.420	--	--	--	0.146	0.633	0.774

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.45	15000	0.2	0.27

Table (4-55) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VIII- Series c)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (c)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		537	--	0.093	0.093	--	--	--	--	--	--	--	--	--	--	--	--
	2	3.00	1.00	2074	0.004	0.061	0.065	0.013	0.219	0.232	--	--	--	--	--	--	--	--	--
	3	6.00	2.00	4619	0.006	0.052	0.058	--	--	--	0.047	0.402	0.449	--	--	--	--	--	--
	4	9.00	3.00	7794	.0081	0.045	.0531	--	--	--	--	--	--	0.101	0.585	0.686	--	--	--
	5	12.00	4.00	11977	0.009	0.040	0.049	--	--	--	--	--	--	--	--	--	0.13	0 567	0.697
	6	15.00	5.00	11977	0.01	0.036	0.049	--	--	--	--	--	--	--	--	--	0.146	0.508	0.654
	7	18.00	6.00	11977	0.008	0.033	0.041	--	--	--	0.086	0.251	0.337	--	--	--	0.158	0.463	0.621
	8	24.00	8.00	11977	0.012	0.028	0.040	--	--	--	0.06	0.215	0.311	--	--	--	0.177	0.396	0.573

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.30	15000	0.4	0.27

Table (4-56) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group VIII- Series d)

Working Load (kPa)					180 kPa			700 kPa			1539 kPa			2600 kPa			2853 kPa		
Series (d)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		537	-	0.093	0.093	--	--	--	--	--	--	--	--	--	--	--	--
	2	3.00	1.00	2074	0.004	0.061	0.064	0.007	0.219	0.226	--	--	--	--	--	--	--	--	--
	3	6.00	2.00	4619	0.009	0.052	0.056	--	--	--	0.031	0.401	0.432	--	--	--	--	--	--
	4	9.00	3.00	7794	0.006	0.045	0.051	--	--	--	--	--	--	0.072	0.582	0.654	--	--	--
	5	12.00	4.00	11977	0.006	0.040	0.046	--	--	--	0.274	0.306	0.358	--	--	--	0.096	0.563	0.659
	6	18.00	6.00	11977	0.009	0.032	0.041	--	--	--	0.067	0.249	0.316	--	--	--	0.124	0.457	0.581
	7	24.00	8.00	11977	.0094	.0276	0.037	--	--	--	0.077	0.212	0.289	--	--	--	0.231	0.391	0.532

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0..45	15000	0.4	0.27

Table (4-57) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group VIII - Series e)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (e)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		360	-	.064	.064	-	-	-	-	-	-	-	-	-			
	2	3.00	1.5	2115	.0026	.0542	.0568	0.01	0.193	0.203	-	-	-	-	-	-	--	--	--
	3	9.00	4.5	5706	.0059	.0415	.0474	0.012	0.189	0.201	-	-	-	.075	.537	.612	--	--	--
	4	15.00	7.5	5706	.0075	.0351	.0426	-	-	-	-	-	-	.077	.530	.607	0.107	0.498	0.605
	5	21.00	10.5	5706	.0086	.0313	.0399	-	-	-	-	-	-	.080	.527	.606	0.123	0.444	0.567

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.3	15000	0.2	0.27

Table (4-58) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group VIII - Series f)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (f)	Test No	H (m)	H/B	q_u kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		360	-	.064	.064	-	-	-	-	-	-	-	-	-			
	2	3.00	1.5	2115	.0001	.054	.055	0.004	0.192	0.196	-	-	-	-	-	-	--	--	--
	3	9.00	4.5	5706	.0004	.041	.045	0.006	0.189	0.195	-	-	-	.051	.535	.586	--	--	--
	4	15.00	7.5	5706	.006	.035	.041	0.008	0.185	0.193	-	-	-	.055	.532	.587	0.082	0.494	0.576
	5	21.00	10.5	5706	.007	.031	.038	-	-	-	-	-	-	.057	.528	.585	0.097	0.441	0.538

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.45	15000	0.2	0.27

Table (4-59) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group VIII - Series g)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (g)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		360	-	.049	.049	-	-	-	-	-	-	-	-	-			
	2	3.00	1.5	2115	.002	.042	.044	0.006	0.151	0.157	-	-	-	-	-	-	--	--	--
	3	9.00	4.5	5706	.004	.031	.035	0.008	0.148	0.156	-	-	-	.054	.394	.448	--	--	--
	4	15.00	7.5	5706	.0059	.0238	.0297	0.01	0.145	0.155	-	-	-	.057	.390	.447	0.083	0.338	0.421
	5	21.00	10.5	5706	.0069	.0198	.0267	-	-	-	-	-	-	.059	.386	.445	0.097	0.281	0.378

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.45	15000	0.4	0.27

Table (4-60) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group VIII - Series h)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (h)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		360	-	.049	.049	-	-	-	-	-	-	-	-	-			
	2	3.00	1.5	2115	.003	.042	.045	0.01	0.151	0.161	-	-	-	-	-	-	--	--	--
	3	9.00	4.5	5706	.0059	.0306	.0365	0.011	0.148	0.158	-	-	-	.076	.396	.472	--	--	--
	4	15.00	7.5	5706	.0076	.0241	.0317	0.017	0.143	0.16	-	-	-	.070	.390	.46	0.108	0.341	0.449
	5	21.00	10.5	5706	.009	.020	.029	-	-	-	-	-	-	.068	.388	.456	0.123	0.284	0.407

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.30	15000	0.4	0.27

Table (4-61) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group VIII - Series i)(Group VIII - Series j)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (i&j)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
(i)	1	0	-	180	-	.034	0.034	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2598	.0009	.028	.0289	0.002	0.099	0.101	-	-	-	-	-	-	-	-	-
	3	9.00	9.00	2853	.002	.021	.023	.01	.089	.099	-	-	-	.03	.269	.299	-	-	-
	4	15.00	15.00	2853	.004	.017	.021	-	-	-	-	-	-	0.03	.25	.28	.045	.248	.293
(j)	1	0		180		.034	.034												
	2	3.00	3.00	2598	.0016	.0278	.0294	0.006	0.099	0.105	-	-	-	-	-	-	-	-	-
	3	9.00	9.00	2853	.0031	.0209	.024	.007	.096	.103	-	-	-	.043	.271	.314	-	-	-
	4	15.00	15.00	2853	.004	.018	.022	--	-	--	-	-	-	.051	.262	.313	.06	.249	.309

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.45	15000	0.2	0.27
55000	0.3	15000	0.2	0.27

Table (4-62) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group VIII - Series k)(Group VIII - Series l)

Working Load (kPa)					180 kPa			700 kPa			1540 kPa			2600 kPa			2853 kPa		
Series (k&l)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
(k)	1	0	-	180	-	.026	.026	-	-	-	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2598	.0017	.0219	.0236	0.006	0.078	0.084	-	-	-	-	-	-	-	-	-
	3	9.00	9.00	2853	.0035	.0154	.0189	..007	.076	.083	-	-	-	.044	.200	.244	-	-	-
	4	15.00	15.00	28537	.0039	.0121	.016	-	-	-	-	-	-	.046	.19	.236	.061	.171	.232
(l)	1	0		180		.026	.026												
	2	3.00	3.00	2598	.001	.022	.023	0.004	0.078	0.082	-	-	-	-	-	-	-	-	-
	3	9.00	9.00	2853	.002	.016	.018	.005	.076	.081	-	-	-	.032	.199	.231	-	-	-
	4	15.00	15.00	11977	.003	.012	.015	.006	.074	.080	-	-	-	.038	.182	.22	.047	.169	.216

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.3	15000	0.4	0.27
55000	0.45	15000	0.4	0.27

Table (4-63) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group IX- Series a)

Working Load (kPa)					300 kPa			972 kPa			1940kPa			2853 kPa		
Series (a)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		897	--	0.067	0.067	--	--	--	--	--	--	--	--	--
	2	3.00	1.00	2918	0.006	0.060	0.066	0.018	0.186	0.204	--	--	--	--	--	--
	3	6.00	2.00	5822	0.01	0.052	0.062	0.031	0.160	0.191	0.061	0.316	0.377	--	--	--
	4	9.00	3.00	8711	0.012	0.046	0.058	0.039	0.140	0.179	--	--	--	0.114	0.405	0.519
	5	12.00	4.00	8711	0.014	0.041	0.055	--	--	--	0.009	0.246	0.336	0.132	0.361	0.493
	6	15.00	5.00	8711	0.016	0.037	0.053	0.051	0.113	0.164	--	--	--	0.148	0.325	0.473
	7	18.00	6.00	8711	0.018	0.033	0.051	--	--	--	0.109	0.203	0.312	0.16	0.297	0.457

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0..3	25000	0.40	0.45

Table (4-64) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group IX- Series b)

Working Load (kPa)					300 kPa			972 kPa			1540 kPa			2853 kPa		
Series (b)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		897	--	0.067	0.067	--	--	--	--	--	--	--	--	--
	2	3.00	1.00	2918	.0037	.0603	0.064	0.01	0.186	0.196	--	--	--	--	--	--
	3	6.00	2.00	5822	0.006	0.052	0.058	0.018	0.161	0.179	0.037	0.317	0.354	--	--	--
	4	9.00	3.00	8711	0.008	0.046	0.054	--	--	--	0.053	0.277	0.330	0.078	0.406	0.484
	5	12.00	4.00	8711	.0102	0.041	0.513	0.033	0.125	0.158	--	--	--	0.093	0.360	0.457
	6	15.00	5.00	8711	0.013	0.036	0.049	--	--	--	0.076	0.221	0.297	0.112	0.324	0.436
	7	18.00	6.00	8711	0.014	0.033	0.047	0.043	0.102	0.145	--	--	--	0.124	0.295	0.419

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^3	μ_2	E_2/E_1
55000	0.45	25000	0.4	0.45

Table (4-65) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group IX- Series c)

Working Load (kPa)					300 kPa			972kPa			1940 kPa			2853 kPa		
Series (c)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of l ayers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		897	--	0.088	0.088	--	--	--	--	--	--	--	--	--
	2	3.00	1.00	2918	0.006	0.077	0.083	0.049	0.24	0.256	--	--	--	--	--	--
	3	6.00	2.00	5822	0.009	0.068	0.077	0.029	0.21	0.239	0.058	0.414	0.472	--	--	--
	4	9.00	3.00	8711	0.011	0.061	0.074	--	--	--	0.076	0.372	0.448	0.11	0.546	0.656
	5	12.00	4.00	8711	0.015	0.056	0.071	0.045	0.173	0.218	--	--	--	0.131	0.500	0.631
	6	15.00	5.00	8711	0.016	0.052	0.068	--	--	--	0.1	0.318	0.418	0.146	0.466	0.612
	7	18.00	6.00	8711	0.018	0.049	0.067	0.055	0.151	0.206	--	--	--	0.16	0.438	0.598

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.3	25000	0.2	0.45

Table (4-66)Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group IX- Series d)

Working Load (kPa)					300 kPa			972 kPa			1940 kPa			2853 kPa		
Series (d)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0		897	--	0.088	0.088	--	--	--	--	--	--	--	--	--
	2	3.00	1.00	2918	.0026	0.077	.0769	0.008	0.237	0.245	--	--	--	--	--	--
	3	6.00	2.00	5822	0.005	0.068	0.073	0.017	0.209	0.226	0.039	0.412	0.446	--	--	--
	4	9.00	3.00	8711	.0084	0.061	.0694	0.026	0.188	0.214	--	--	--	0.074	0.594	0.618
	5	12.00	4.00	8711	0.01	0.056	0.066	--	--	--	0.064	0.340	0.404	0.094	0.498	0.592
	6	15.00	5.00	8711	0.012	0.052	0.064	0.038	0.160	0.198	--	--	--	0.109	0.464	0.573
	7	18.00	6.00	8711	0.014	0.048	0.062	--	--	--	0.083	0.298	0.381	0.122	0.436	0.558

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.45	25000	0.2	0.45

Table (4-67) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group IX - Series e) (Group IX - Series f)

Working load (kPa)					300 kPa			972 kPa			1940 kPa			2853 kPa		
Series (e & f)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
(e)	1	0	-	600	-	.047	.047	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2841	.0048	.0416	.0464	0.015	0.128	0.143	-	-	-	-	-	-
	3	9.00	4.5	5706	.009	.031	.040	0.019	0.123	0.142	-	-	-	.086	.274	.360
	4	15.00	7.5	5706	.0122	.0245	.0367	-	-	-	-	-	-	.009	.218	.227
(f)	1	0		600	-	.047	.047	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2841	.0023	.0417	.044	0.007	0.129	0.136	-	-	-	-	-	-
	3	9.00	4.5	5706	.007	.031	.038	0.009	0.120	0.129	-	-	-	.059	.275	.334
	4	15.00	7.5	5706	.01	.024	.034	-	-	-	-	-	-	.083	.218	.301

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.3	25000	0.4	0.45
55000	0.45	25000	0.4	0.45

Table (4-68) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group IX - Series g) (Group IX - Series h)

Working Load (kPa)					300 kPa			972 kPa			1940 kPa			2853 kPa		
Series (g&h)	Test No	H (m)	H/B	q_{ix} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
(g)	1	0	-	600	-	.062	.062	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2841	.002	.053	.055	0.006	0.163	0.169	-	-	-	-	-	-
	3	9.00	4.5	5706	.006	.041	.047	0.008	0.160	0.168	-	-	-	.057	.367	.424
	4	15.00	7.5	5706	.009	.035	.044	-	-	-	-	-	-	.082	.310	.392
(h)	1	0		600	-	.062	.062	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2841	.005	.053	.058	0.013	0.164	0.177	-	-	-	-	-	-
	3	9.00	4.5	5706	.01	.041	.051	0.015	0.161	0.176	-	-	-	.084	.368	.452
	4	15.00	7.5	5706	.012	.035	.047	-	-	-	-	-	-	.107	.312	.419

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.45	25000	0.2	0.45
55000	0.3	25000	0.2	0.45

Table (4-69) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group IX - Series I)(Group IX - Series J)

Working Load (kPa)					300 kPa			972 kPa			1940 kPa			2853 kPa		
Series (i&J)	Test No	H (m)	H/B	qut kN/m^2	Settlement of layers (m)			Settlement of Layers (m)			Settlement of Layers (m)			Settlement of Layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
(i)	1	0	-	300	-	.067	.067	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2853	.001	.022	.023	.004	.067	.071	-	-	-	-	-	-
	3	9.00	9.00	2853	.003	.016	.019	.004	.066	.070	-	-	-	.035	.139	.174
(j)	1	0	-	300	-	.067	.067	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2853	.003	.022	.025	.009	.067	.076	-	-	-	-	-	-
	3	9.00	9.00	2853	.005	.016	.021	.009	.066	.075	-	-	-	.049	.139	.188

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.45	25000	0.4	0.45
55000	0.3	25000	0.4	0.45

Table (4-70) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group IX - Series k)(Group IX - Series l)

Working Load (kPa)					300 kPa			972 kPa			1940 kPa			2853 kPa		
Series (k&L)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of Layers (m)			Settlement of Layers (m)			Settlement of Layers (m)			Settlement of Layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
(k)	1	0	-	300	-	.032	.032	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2853	.003	.027	.030	.008	.085	.093	-	-	-	-	-	-
	3	9.00	9.00	2853	.005	.021	.026	.009	.081	.09	-	-	-	.048	.186	.234
(l)	1	0	-	300	-	.032	.032	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2853	.001	.027	.028	.004	.084	.088	-	-	-	-	-	-
	3	9.00	9.00	2853	.004	.021	.025	.012	.064	.076	-	-	-	.032	.186	.218

soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
55000	0.3	25000	0.2	0.45
55000	0.45	25000	0.2	0.45

Table (4-71) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group X - Series a)

Working Load (kPa)					180 kPa			635 kPa			1300 kPa			1555 kPa		
Series (a)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	537	-	.174	.174	-	-	-	-	-	-	-	-	-
	2	3.00	1.00	1905	.036	.144	.148	.014	.468	.482	-	-	-	-	-	-
	3	600	2.00	3921	.007	.125	.132	.023	.405	.428	.046	.814	.860	-	-	-
	4	9.00	3.00	6585	.01	.111	.121	.03	.362	.392	.061	.727	.788	.071	.868	.939
	5	12.00	4.00	6585	.011	.102	.113	.035	.331	.366	.072	.664	.736.	.086	.792	.878
	6	15.00	5.00	6585	.012	.095	.107	.04	.307	.347	.08	.617	.697	.096	.736	.832
	7	18.00	6.00	6585	.013	.089	.102	.043	.289	.332	.088	.580	.668.	.105	.692	.797
	8	21.00	7.00	6585	.014	.085	.099	.046	.275	.321	.094	.552	.646.	.11	.659	.770
	9	24.00	8.00	6585	.015	.081	.096	.049	.264	.313	.098	.531	.629	.118	.632	.750

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.30	8000	0.20	0.18

Table (4-72) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group X - Series b)

Working Load (kPa)					180 kPa			635 kPa			1300 kPa			1555 kPa		
Series (b)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	537	-	.174	.174	-	-	-	-	-	-	-	-	-
	2	3.00	1.00	1905	.002	.144	.146	.007	.465	.472	-	-	-	-	-	-
	3	600	2.00	3921	.004	.124	.128	.025	.402	.427	.03	.808	.838	-	-	-
	4	9.00	3.00	6585	.006	.11	.117	.021	.359	.380	.043	.721	.764	.051	.861	.912
	5	12.00	4.00	6585	.008	.101	.109	.026	.328	.354	.054	.659	.713	.063	.786	.849
	6	15.00	5.00	6585	.009	.094	.103	.031	.304	.335	.063	.611	.674	.074	.729	.803
	7	18.00	6.00	6585	.011	.088	.099	.035	.286	.321	.069	.575	.644	.061	.686	.768
	8	21.00	7.00	6585	.011	.084	.095	.039	.27	.309	.075	.547	.622	.089	.653	.742
	9	24.00	8.00	6585	.012	.081	.093	.039	.262	.301	.079	.526	.605	.125	.597	.722

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.45	8000	0.20	0.18

Table (4-73) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group X - Series c)

Working Load (kPa)					180 kPa			635 kPa			1300 kPa			1555 kPa		
Series (c)	Test No	H (m)	H/B	q_{ux} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	537	-	.132	.132	-	-	-	-	-	-	-	-	-
	2	3.00	1.00	1905	.0005	.112	.117	.015	.363	.378	-	-	-	-	-	-
	3	9.00	3.00	6585	.009	.081	.090	-	-	-	.002	.527	.589	.074	.628	.702
	4	15.00	5.00	6585	.096	.064	.076	.04	.205	.254	-	-	-	.092	.492	.588
	5	21.00	7.00	6585	.015	.052	.067	-	-	-	.093	.344	.437	.112	.409	.521
	6	24.00	8.00	6585	.016	.049	.065	-	-	-	-	-	-	.117	.385	.502

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.30	8000	0.40	0.18

Table (4-74) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group X - Series d)

Working Load (kPa)					180 kPa			635 kPa			1300 kPa			1555 kPa		
Series (d)	Test No	H (m)	H/B	q_{ux} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	537	-	.132	.132	-	-	-	-	-	-	-	-	-
	2	3.00	1.00	1905	.002	.112	.114	.009	.362	.371	-	-	-	-	-	-
	3	9.00	3.00	6585	.008	.079	.087	-	-	-	-	-	-	.054	.622	.676
	4	15.00	5.00	6585	.01	.062	.072	-	-	-	-	-	-	.076	.485	.561
	5	21.00	7.00	6585	.013	.051	.064	-	-	-	-	-	-	.09	.403	.493
	6	24.00	8.00	6585	.013	.048	.061	-	-	-	-	-	-	.095	.379	.474

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.45	8000	0.40	0.18

Table (4-75) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group X - Series e)

Working Load (kPa)					180 kPa			635 kPa			1300 kPa			1555kPa		
Series (e)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	360	-	.121	.121	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	1888	.003	.099	0.102	0.01	0.32	0.330	-	-	-	-	-	-
	3	9.00	4.5	3111	.007	.075	.082	0.014	0.29	0.304	.046	.489	.535	-	-	-
	4	15.00	7.5	3111	.01	.063	.073	0.016	0.29	0.276	.050	.483	.533	.071	.492	.563
	5	21.00	10.5	3111	.01	.057	.067	-	-	-	.052	.477	.529	.082	.439	.521

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.3	8000	0.2	0.18

Table (4-76) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group X - Series f)

Working load (kPa)					180 kPa			635 kpa			1300 kPa			1555kPa		
Series (f)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	360	-	.121	.121	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	1888	.0018	.098	.0998	0.005	0.318	0.323	-	-	-	-	-	-
	3	9.00	4.5	3111	.0049	.0746	.0795	0.007	0.310	0.317	.032	.486	.518	-	-	-
	4	15.00	7.5	3111	.0063	.063	.0693	-	-	-	.046	.409	.455	.055	.488	.543
	5	21.00	10.5	3111	.008	.056	.064	-	-	-	.050	.403	.453	.066	.435	.501

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.45	8000	0.2	0.18

Table (4-77) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group X - Series g)

Working Load (kPa)					180 kPa			635 kPa			1300 kPa			1555kPa		
Series (g)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	360	-	.093	.093	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	1888	.0036	.077	.0806	0.012	0.249	0.261	-	-	-	-	-	-
	3	9.00	4.5	3111	.0067	.055	.0617	0.014	0.240	0.254	.047	.355	.402	-	-	-
	4	15.00	7.5	3111	.0096	.042	.0516	.016	.234	.250	.050	.348	.398	.072	.329	.401
	5	21.00	10.5	3111	.011	.035	.046	-	-	-	.053	.340	.393	.081	.274	.355

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.3	8000	0.4	0.18

Table (4-78) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group X - Series h)

Working Load (kPa)					180 kPa			635 kPa			1300 kPa			1555kPa		
Series (h)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	360	-	.093	.093	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	1888	.0022	.0769	.0791	.007	0.249	0.256	-	-	-	-	-	-
	3	9.00	4.5	3111	.0051	.0541	.0592	.009	0.242	0.251	.033	.353	.386	-	-	-
	4	15.00	7.5	3111	.0073	.0418	.0491	-	-	-	.035	.350	.385	.056	.325	.381
	5	21.00	10.5	3111	.0081	.035	.0431	-	-	-	.033	.348	.381	.066	.269	.335

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.45	8000	0.4	0.18

Table (4-79) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m
(Group X - Series i)(Group X - Series j)

Working Load (kPa)					180 kPa			635 kPa			1300 kPa			q_a = 1555 kPa		
Series (i & j)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
(i)	1	0	-	180	-	.048	.048	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2244	.003	.039	.042	0.005	0.129	0.134	-	-	-	-	-	-
	3	9.00	9.00	2717	.003	.027	.030	0.005	0.125	0.130	0.019	0.178	0.197	-	-	-
	4	15.00	15.00	2717	.004	.021	.025	-	-	-	0.026	0.137	0.163	0.032	0.163	0.195
(j)	1	0	0	180		.048	.048				-	-	-	-	-	-
	2	3.00	3.00	2244	.003	.039	.042	0.006	0.129	0.135	-	-	-	-	-	-
	3	9.00	9.00	2717	.005	.027	.032	0.006	0.126	0.132	0.027	0.179	0.206	-	-	-
	4	15.00	15.00	2717	.005	.021	.026	-	-	-	0.014	0.176	0.19	0.04	0.165	0.205

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.45	8000	0.4	0.18
45000	0.3	8000	0.4	0.18

Table (4-80) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group X - Series k)(Group X - Series l)

Working Load (kPa)					180 kPa			635 kPa			1300 kPa			1555 kPa		
Series (k & l	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
(k)	1	0	-	180	-	.063	.063	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2244	.003	.05	.053	0.006	0.164	0.17	-	-	-	-	-	-
	3	9.00	9.00	2717	.004	.038	.042	0.01	0.160	0.15	0.026	0.247	0.273	-	-	-
	4	15.00	15.00	2717	.005	.032	.037	-	-	-	0.026	0.244	0.270	0.039	0.247	0.286
(l)	1	0	0	180		.063	.063				-	-	-	-	-	-
	2	3.00	3.00	2244	.001	.05	.051	0.003	0.166	0.163	-	-	-	-	-	-
	3	9.00	9.00	2717	.004	.037	.041	0.004	0.164	0.160	0.018	0.245	0.263	-	-	-
	4	15.00	15.00	2717	.004	.031	.035	-	-	-	0.02	0.240	0.260	0.032	0.244	0.276

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.45	8000	0.4	o.18
45000	0.3	8000	0.4	0.18

Table (4-81) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XI - Series a)

Working Load (kPa)					180 kPa			635 kPa			1300 kPa			1555 kPa		
Series (a)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	537	-	.093	.093	-	-	-	-	-	-	-	-	-
	2	3.00	1.00	1905	.005	.079	.084	.014	.259	.273	-	-	-	-	-	-
	3	6.00	2.00	3921	.008	.069	.077	-	-	-	.047	.455	.502	-	-	-
	4	9.00	3.00	6585	.009	.063	.072	.034	.223	.257	-	-	-	.074	.487	.561
	5	12.00	4.00	6585	.011	.057	.068	-	-	-	.073	.374	.447	.087	.446	.553
	6	15.00	5.00	6585	.013	.053	.066	-	-	-	.081	.348	.429	.097	.415	.512

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.30	15000	0.20	0.34

Table (4-82) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XI - Series b)

Working Load (kPa)					180 kPa			635 kPa			1300 kPa			1555 kPa		
Series (b)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	537	-	.093	.093	-	-	-	-	-	-	-	-	-
	2	3.00	1.00	1905	.003	.079	.082	.006	.258	.264	-	-	-	-	-	-
	3	6.00	2.00	3921	.005	.069	.074	-	-	-	.028	.453	.481	-	-	-
	4	9.00	3.00	6585	.006	.060	.066	.021	.202	.223	-	-	-	.05	.485	.535
	5	12.00	4.00	6585	.008	.057	.065	-	-	-	..062	.346	.408	.073	.413	.486
	6	15.00	5.00	6585	.01	.053	.063	-	-	-	.081	.348	.429	.082	.388	.470

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.45	15000	0.20	0.34

Table (4-83) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XI - Series c)

Working Load (kPa)					180 kPa			635 kPa			1300 kPa			1555 kPa		
Series (c)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	537	-	.071	.071	-	-	-	-	-	-	-	-	-
	2	3.00	1.00	1905	.002	.063	.065	.0081	.201	.209	-	-	-	-	-	-
	3	6.00	2.00	3921	.005	.053	.058	.015	.172	.187	.031	.346	.377	-	-	-
	4	12.00	4.00	6585	.008	.041	.049	-	-	-	.054	.266	.320	.065	.317	.382
	5	15.00	5.00	6585	.01	.037	.047	-	-	-	-	-	-	.074	.288	.362

Soil Properties

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.45	15000	0.40	0.34

Table (4-84) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XI - Series d)

Working Load (kPa)					180 kPa			635 kPa			1300 kPa			1555 kPa		
Series (d)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	537	-	.071	.071	-	-	-	-	-	-	-	-	-
	2	3.00	1.00	1905	.005	.062	.067	.015	.201	.216	-	-	-	-	-	-
	3	6.00	2.00	3921	.008	.053	.061	.025	.172	.197	.049	.346	.395	-	-	-
	4	12.00	4.00	6585	.011	.041	.052	-	-	-	.074	.267	.341	.088	.318	.406
	5	15.00	5.00	6585	.01	.038	.048	-	-	-	-	-	-	.08	.290	.370

Soil Properties:

E_1 (kN/m^2)	μ_1	E_2 (kN/m^2)	μ_2	E_2/E_1
45000	0.30	15000	0.40	0.34

Table (4-85) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group XI - Series e) (Group XI - Series f)

Working Load (kPa)					180 kPa			635 kPa			1300 kPa			1555 kPa		
Series (e & f)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
(e)	1	0	-	360	-	.064	.064	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	1888	.0015	.0545	.0560	0.005	0.177	0.182	-	-	-	-	-	-
	3	9.00	4.5	3111	.0048	.0421	.0469	0.007	0.172	0.179	.032	.274	.306	-	-	-
	4	15.00	7.5	3111	.0071	.0355	.0426	0.009	0.168	0.177	.030	.270	.300	.055	.276	.331
(f)	1	0	-	360	-	.064	.064	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	1888	.0031	.055	.0581	0.011	0.177	0.188	-	-	-	-	-	-
	3	9.00	4.5	3111	.0072	.0422	.0494	0.014	0.172	0.186	.047	.275	.322	-	-	-
	4	15.00	7.5	3111	.009	.036	.045	-	-	-	.050	.270	.320	.071	.278	.349

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.45	15000	0.2	0.34
45000	0.3	15000	0.2	0.34

Table (4-86) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group XI - Series g) (Group XI - Series h)

Working Load (kPa)					180 kPa			635 kPa			1300 kPa			1555 kPa		
Series (g & h	Test No	H (m)	H/B	q_{kz} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
(g)	1	0	-	360	-	.049	.049	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	1888	.0036	.0429	.0465	0.012	0.139	0.151	-	-	-	-	-	-
	3	9.00	4.5	3111	.0073	.0313	.0386	0.014	0.133	0.147	.047	.204	.251	-	-	-
	4	15.00	7.5	3111	.0094	.0247	.0341	-	-	-	.050	.200	.250	.073	.192	.265
(h)	1	0		360	-	.049	.049	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	1888	.002	.043	.045	0.007	0.139	0.146	-	-	-	-	-	-
	3	9.00	4.5	3111	.005	.031	.036	0.009	0.134	0.143	.032	.204	.236	-	-	-
	4	15.00	7.5	3111	.007	.025	.032	--	-	--	.047	.160	.207	.056	.191	.247

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.3	15000	0.4	0.34
45000	0.45	15000	0.4	0.34

Table (4-87) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group XI - Series i)(Group XI - Series j)

Working Load (kPa)					180 kPa			635 kPa			1300 kPa			1555 kPa		
Series (i&j)	Test N	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
(i)	1	0	-	180	-	.034	.034	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2244	.0008	.0281	.0289	0.003	0.091	0.094	-	-	-	-	-	-
	3	9.00	9.00	2717	.0028	.0213	.0241	0.002	0.090	0.092	0.026	0.157	0.183	-	-	-
	4	15.00	15.00	2717	.004	.018	.022	-	-	-	0.030	0.150	0.180	0.031	0.138	0.169
(j)	1	0	0	180		.034	.034				-	-	-	-	-	-
	2	3.00	3.00	2244	.0021	.028	.0301	0.007	0.091	0.098	-	-	-	-	-	-
	3	9.00	9.00	2717	.004	.021	.025	0.007	0.088	0.095	0.027	0.139	0.168	-	-	-
	4	15.00	15.00	2717	.005	.018	.023	-	-	-	-	-	-	0.04	0.139	0.179

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.45	15000	0.2	0.34
45000	0.3	15000	0.2	0.34

Table (4-88) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group XI - Series k)(Group XI - Series l)

Working Load (kPa)					180 kPa			635 kPa			1300 kPa			1555 kPa		
Series (k&l)	Test No	H (m)	H/B	q_{tr} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
(k)	1	0	-	180	-	.026	.026	-	-	-	-	-	-	-	-	-
	2	3.00	3.00	2244	.002	.022	.024	0.006	0.072	0.078	-	-	-	-	-	-
	3	9.00	9.00	2717	.004	.016	.020	0.006	0.070	0.076	0.028	0.103	0.131	-	-	-
	4	15.00	15.00	2717	.006	.012	.018	-	-	-	0.030	0.098	0.128	0.041	0.096	0.137
(l)	1	0	0	180		.026	.026				-	-	-	-	-	-
	2	3.00	3.00	2244	.002	.022	.024	0.004	0.072	0.076	-	-	-	-	-	-
	3	9.00	9.00	2717	.002	.016	.018	0.006	0.052	0.061	0.019	0.103	0.122	-	-	-
	4	15.00	15.00	2717	.004	.012	.016	-	-	-	0.030	0.097	0.117	0.031	0.096	0.127

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.45	15000	0.4	0.34
45000	0.3	15000	0.4	0.34

Table (4-89) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XII - Series a)

Working Load (kPa)					300kPa			908 kPa			1300 kPa			1555 kPa		
Series (a)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	897	-	.088	.088	-	-	-	-	-	-	-	-	-
	2	3.00	1.00	2726	.004	.077	.081	.009	.224	.233	-	-	-	-	-	-
	3	6.00	2.00	5202	.007	.069	.076	.02	.198	.218	.028	.282	.310	.033	.336	.369
	4	9.00	3.00	5202	.01	.062	.072	-	-	-	.042	.254	.296	.051	.302	.353
	5	12.00	4.00	5202	.012	.057	.069	.037	.164	.201	-	-	-	.063	.278	.341

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.45	25000	0.20	0.23

Table (4-90) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XII - Series b)

Working Load (kPa)					300kPa			908 kPa			1300 kPa			1555 kPa		
Series (b)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	897	-	.088	.088	-	-	-	-	-	-	-	-	-
	2	3.00	1.00	2726	.007	.079	.085	.02	.226	.246	-	-	-	-	-	-
	3	6.00	2.00	5202	.012	.069	.081	.034	.199	.233	.048	.283	.331	.058	.337	.395
	4	9.00	3.00	5202	.016	.062	.078	.045	.179	.224	-	-	-	.078	.303	.379
	5	12.00	4.00	5202	.018	.057	.075	-	-	-	.073	.234	.307	.088	.279	.367

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.30	25000	0.20	0.23

Table (4-91) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XII - Series c)

Working Load (kPa)					300kPa			908 kPa			1300 kPa			1555 kPa		
Series (c)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	897	-	.067	.067	-	-	-	-	-	-	-	-	-
	2	3.00	1.00	2726	.004	.061	.065	.011	.175	.186	-	-	-	-	-	-
	3	6.00	2.00	5202	.008	.053	.061	.022	.153	.176	.031	.217	.248	.037	.259	.296
	4	9.00	3.00	5202	.011	.046	.057	-	-	-	.044	.190	.234	.052	.227	.279
	5	12.00	4.00	5202	.013	.041	.054	.039	.1119	.158	-	-	-	..065	.202	.267

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.45	25000	0.40	0.23

Table (4-92) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XII - Series d)

Working Load (kPa)					300kPa			908 kPa			1300 kPa			1555 kPa		
Series (d)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	897	-	,067	.067	-	-	-	-	-	-	-	-	-
	2	3.00	1.00	2726	.007	.061	.068	.022	.175	.197	-	-	-	-	-	-
	3	6.00	2.00	5202	.012	.053	.065	.035	.152	.187	.05	.216	.226	.066	.258	.318
	4	9.00	3.00	5202	.016	.046	.062	.045	.133	.178	-	-	-	.077	.226	.303
	5	12.00	4.00	5202	.018	.041	.059	-	-	-	.075	.169	.244	.089	.202	.291

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.30	25000	0.40	0.23

Table (4-93) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group XII - Series e) (Group XII - Series f)

Working Load (kPa)					300 kPa			908 kPa			1300 kPa			1555 kPa		
Series (e & f)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
(e)	1	0	-	600	-	.047	.047	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2589	.003	.042	.045	0.009	0.122	0.131	-	-	-	-	-	-
	3	9.00	4.5	3111	.0081	.0316	.0397	0.01	0.116	0.126	.034	.129	.163	-	-	-
	4	15.00	7.5	3111	.011	.025	.036	0.013	0.111	0.124	0.036	0.125	0.161	.056	.122	.178
(f)	1	0		600	.	.047	.047									
	2	3.00	1.5	2589	.0058	.0421	.0479	0.017	0.121	0.138	-	-	-	-	-	-
	3	9.00	4.5	3111	.012	.031	.043	0.019	0.118	0.137	.049	.128	.177	-	-	-
	4	15.00	7.5	3111	-	-	-	0.021	0.115	0.136	.061	.103	.164	.074	.122	.196

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.45	25000	0.4	0.56
45000	0.3	25000	0.4	0.56

Table (4-94) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.oom (Group XII - Series g) (Group XII - Series h)

Working Load (kPa)					300 kPa			908 kPa			1300 kPa			1555 kPa		
Series (g & h	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total	upper	lower	total
(g)	1	0	-	600	-	.062	.062	-	-	-	-	-	-	-	-	-
	2	3.00	1.5	2589	.005	.054	.059	0.016	0.155	0.171	-	-	-	-	-	-
	3	9.00	4.5	3111	.012	.042	.054	0.019	0.150	0.169	.047	.172	.219	-	-	-
	4	15.00	7.5	3111	-	-	-	-	-	-	.061	.146	.207	.073	.174	.247
(h)	1	0		600		.062	.062									
	2	3.00	1.5	2589	.002	.054	.056	0.007	0.154	0.161	-	-	-	-	-	-
	3	9.00	4.5	3111	.007	.042	.049	0.009	0.150	0.159	.032	.172	.204	-	-	-
	4	15.00	7.5	3111	.011	.036	.047	-	-	-	.046	.145	.191	.055	.173	.228

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.3	25000	0.2	0.56
45000	0.45	25000	0.2	0.56

Table (4-95) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group XII - Series I)(Group XII - Series J)

Working Load (kPa)					300 kPa			908 kPa			1300 kPa		
Series i&j	Test N	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
(i)	1	0	-	300	-	.032	.032	-	-	-	-	-	-
	2	3.00	3.00	2717	.002	.027	.029	0.005	0.079	0.084	-	-	-
	3	9.00	9.00	2717	.004	.022	.026	0.013	0.061	0.074	0.018	0.087	0.105
(j)	1	0	0	300		.032	.032				-	-	-
	2	3.00	3.00	2717	.004	.028	.032	0.011	0.082	0.083	-	-	-
	3	9.00	9.00	2717	.006	.021	.027	0.012	0.078	0.090	0.027	0.087	0.114

Soil properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.45	25000	0.2	0.56
45000	0.3	25000	0.2	0.56

Table (4-96) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m
(Group XII - Series K)(Group XII - Series L)

Working Load (kPa)					300 kPa			908 kPa			1300 kPa		
Series (k&l)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
(k)	1	0	-	300	-	.025	.025	-	-	-	-	-	-
	2	3.00	3.00	2717	.004	.023	.027	0.011	0.065	0.076	-	-	-
	3	9.00	9.00	2717	.007	.016	.023	0.012	0.061	0.073	0.028	0.065	0.093
(l)	1	0	0	300	-	.025	.025				-	-	-
	2	3.00	3.00	2717	.002	.022	.024	0.005	0.063	0.068	-	-	-
	3	9.00	9.00	2717	.005	.016	.021	0.006	0.060	0.066	0.019	0.066	0.085

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
45000	0.30	25000	0.4	0.56
45000	0.45	25000	0.4	0.56

Table (4-97) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XIII - Series a)

Working Load (kPa)					180kPa			300 kPa			506 kPa		
Series (a)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	537	-	.132	.132	-	-	-	-	-	-
	2	3.00	1.00	1671	.004	.114	.118	-	-	-	.013	.296	.309
	3	9.00	3.00	1671	.01	.083	.093	-	-	-	.027	.216	.243
	4	15.00	5.00	1671	.014	.065	.079	-	-	-	.037	.169	.206
	5	18.00	6.00	1671	.016	.059	.075	-	-	-	.041	.156	.196

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.40	8000	0.40	0.23

Table (4-98) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XIII - Series b)

Working Load (kPa)					180kPa			300 kPa			506 kPa		
Series (b)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	537	-	.132	.132	-	-	-	-	-	-
	2	3.00	1.00	1671	.006	.114	.120	.011	.181	.192	.017	.296	.313
	3	9.00	3.00	1671	.013	.083	.096	.02	.133	.153	.034	.217	.251
	4	15.00	5.00	1671	.017	.066	.083	.026	.105	.131	.044	.171	.215
	5	18.00	6.00	1671	.016	.060	.076	.029	.096	.125	.04	.157	.197

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.25	8000	0.40	0.23

Table (4-99) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XIII - Series c)

Working Load (kPa)					180kPa			300 kPa			506 kPa		
Series (c)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	537	-	.174	.174	-	-	-	-	-	-
	2	3.00	1.00	1671	.007	.146	.153	-	-	-	.016	.382	.398
	3	9.00	3.00	1671	.013	.114	.127	-	-	-	.033	.298	.331
	4	15.00	5.00	1671	.017	.097	.114	-	-	-	.043	.253	.296
	5	18.00	6.00	1671	.018	.091	.109	-	-	-	.047	.238	.285

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.25	8000	0.20	0.23

Table (4-100) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XIII - Series d)

Working Load (kPa)					180kPa			300 kPa			506 kPa		
Series (d)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	537	-	.174	.174	-	-	-	-	-	-
	2	3.00	1.00	1671	.004	.146	.150	-	-	-	.01	.381	.391
	3	9.00	3.00	1671	.01	.114	.124	-	-	-	.018	.331	.349
	4	15.00	5.00	1671	.014	.096	.110	-	-	-	.032	.295	.263
	5	18.00	6.00	1671	.014	.091	.105	-	-	-	.029	.283	.254

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.40	8000	0.20	0.23

Table (4-101) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group XIII - Series e) (Group XIII - Series f)

Working Load (kPa)					180 kPa			300 kPa			506 kPa		
Series (e & f)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
(e)	1	0	-	360	-	.121	.121	-	-	-	-	-	-
	2	3.00	1.5	1013	.003	.100	.103	-	-	-	.007	.261	.268
	3	9.00	4.5	1013	.008	.076	.084	-	-	-	.02	.199	.219
(f)	1	0	-	360	-	.121	.121	-	-	-	-	-	-
	2	3.00	1.5	1013	.005	.100	.105	-	-	-	.012	.262	.274
	3	9.00	4.5	1013	0.01	.077	.087	-	-	-	.025	.200	.225

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.4	8000	0.2	0.23
35000	0.25	8000	0.2	0.23

Table (4-102) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m
(Group XIII - Series g) (Group XIII - Series h)

Working Load (kPa)					180 kPa			300 kPa			506 kPa		
Series (g & h	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
(g)	1	0	-	360	-	.093	.093	-	-	-	-	-	-
	2	3.00	1.5	1013	.005	.078	.083	-	-	-	.013	.204	.217
	3	9.00	4.5	1013	.01	.056	.066	-	-	-	.025	.147	.172
(h)	1	0	-	360	-	.093	.093	-	-	-	-	-	-
	2	3.00	1.5	1013	.004	.078	.082	-	-	-	.01	.204	.214
	3	9.00	4.5	1013	.008	.056	.064	-	-	-	.021	.146	.167

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.25	8000	0.4	0.23
35000	0.4	8000	0.4	0.23

Table (4-103) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.oom
(Group XIII - Series I)(Group XIII - Series J)

Working Load (kPa)					180 kPa			300 kPa			506 kPa		
Series (i&j)	Test No	H (m)	H/B	q_{kz} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
(i)	1	0	-	180	-	.049	.049	-	-	-	-	-	-
	2	3.00	3.00	506	.001	.041	.042	-	-	-	0.005	0.106	0.111
	3	9.00	9.00	506	.005	.028	.033	-	-	-	0.011	0.074	0.085
(j)	1	0	0	180		.049	.049	-	-	-	-	-	-
	2	3.00	3.00	506	.002	.041	.043	-	-	-	0.008	0.105	0.113
	3	9.00	9.00	506	.006	.028	.034	-	-	-	0.015	0.074	0.089

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.4	8000	0.4	0.23
35000	0.25	8000	0.4	0.23

Table (4-104) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m
(Group XIII - Series K)(Group XIII - Series L)

Working Load (kPa)					180 kPa			300 kPa			506 kPa		
Series (k&l)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
(k)	1	0	-	180	-	.063	.063	-	-	-	-	-	-
	2	3.00	3.00	506	.002	.052	.054	-	-	-	0.007	0.134	0.141
	3	9.00	9.00	506	.005	.039	.044	-	-	-	0.014	0.101	0.115
(l)	1	0	0	180		.063	.063	-	-	-	-	-	-
	2	3.00	3.00	506	.002	.051	.053	-	-	-	0.004	0.134	0.138
	3	9.00	9.00	506	.005	.038	.043	-	-	-	0.011	0.101	0.112

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.25	8000	0.2	0.23
35000	0.4	8000	0.2	0.23

Table (4-105) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XiV - Series a)

Working Load (kPa)					180kPa			300 kPa			506 kPa		
Series (a)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	537	-	.092	.092	-	-	-	-	-	-
	2	3.00	1.00	1671	.004	.081	.085	-	-	-	.011	.210	.221
	3	6.00	2.00	1671	.007	.071	.078	-	-	-	.018	.185	.203
	4	9.00	3.00	1671	.01	.064	.074	-	-	-	.026	.166	.192
	5	12.00	4.00	1671	.013	.058	.071	-	-	-	.032	.152	.184

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.40	15000	0.2	0.43

Table (4-106) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XIV - Series b)

Working Load (kPa)					180kPa			300 kPa			506 kPa		
Series (b)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	537	-	.092	.092	-	-	-	-	-	-
	2	3.00	1.00	1671	.006	.081	.087	.01	.129	.139	.016	.212	.228
	3	6.00	2.00	1671	.010	.071	.081	.016	.12	.129	.027	.185	.212
	4	9.00	3.00	1671	..013	.064	.077	.021	.102	.123	.034	.167	.20
	5	12.00	4.00	1671	.016	.058	.074	.024	.094	.118	.04	.153	.193

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.25	15000	0.2	0.43

Table (4-107) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m

(Group XIV - Series c)

Working Load (kPa)					180kPa			300 kPa			506 kPa		
Series (c)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	537	-	.071	.071	-	-	-	-	-	-
	2	3.00	1.00	1671	.004	.063	.067	.007	.100	.107	.012	.164	.176
	3	6.00	2.00	1671	-	-	-	-	-	-	-	-	-
	4	9.00	3.00	1671	.01	.047	.057	.017	.075	.092	.028	.123	.151
	5	12.00	4.00	1671	.012	.042	.054	.02	.067	.087	.033	.109	.142

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.40	15000	0.40	0.43

Table (4-108) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XIV - Series d)

Working Load (kPa)					180kPa			300 kPa			506 kPa		
Series (d)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
	1	0	-	537	-	.071	.071	-	-	-	-	-	-
	2	3.00	1.00	1671	.006	.063	.069	-	-	-	.017	.164	.181
	3	6.00	2.00	1671	-	-	-	-	-	-	-	-	-
	4	9.00	3.00	1671	.014	.047	.061	-	-	-	.034	.124	.156
	5	12.00	4.00	1671	.016	.042	.058	-	-	-	.039	.110	.149

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.25	15000	0.40	0.43

Table (4-109) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group XIV - Series e) (Group XIV - Series f)

Working Load (kPa)					180 kPa			300 kPa			506 kPa		
Series (e & f)	Test No	H (m)	H/B	q_u kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
(e)	1	0	-	360	-	.049	.049	-	-	-	-	-	-
	2	3.00	1.5	1013	.003	.044	.047	-	-	-	.009	.114	.123
	3	9.00	4.5	1013	.007	.032	.039	-	-	-	.02	.084	.104
(f)	1	0	-	360	-	.049	.049	-	-	-	-	-	-
	2	3.00	1.5	1013	.0046	.044	.0486	-	-	-	.014	.113	.217
	3	9.00	4.5	1013	0.01	.0321	.0421	-	-	-	.025	.084	.109

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.4	15000	0.4	0.45
35000	0.25	15000	0.4	0.45

Table (4-110) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group XIV - Series g) (Group XIV- Series h)

Working Load (kPa)					180 kPa			300 kPa			506 kPa		
Series (g & h	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
(g)	1	0	-	360	-	.064	.064	-	-	-	-	-	-
	2	3.00	1.5	1013	.006	.055	.061	-	-	-	.012	.145	.157
	3	9.00	4.5	1013	.01	.043	.053	-	-	-	.025	.113	.138
(h)	1	0	-	360	-	.064	.064	-	-	-	-	-	-
	2	3.00	1.5	1013	.003	.055	.058	-	-	-	.008	.144	.152
	3	9.00	4.5	1013	.0077	.0429	.0506	-	-	-	.013	.119	.132

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.25	15000	0.20	0.45
35000	0.40	15000	0.20	0.45

Table (4-111) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group XIV - Series i)(Group XIV - Series J)

Working Load (kPa)					180 kPa			300 kPa			506 kPa		
Series (i&j)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
(i)	1	0	-	180	-	.034	.034	-	-	-	-	-	-
	2	3.00	3.00	506	.002	.028	.030	-	-	-	0.005	0.074	0.079
	3	9.00	9.00	506	.004	.022	.026	-	-	-	0.012	0.056	0.068
(j)	1	0	0	180		.034	.034	-	-	-	-	-	-
	2	3.00	3.00	506	.003	.029	.032	-	-	-	0.008	0.074	0.082
	3	9.00	9.00	506	.005	.022	.027	-	-	-	0.015	0.057	0.072

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.4	15000	0.2	0.43
35000	0.25	15000	0.2	0.43

Table (4-112) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group XIV - Series k)(Group XIV - Series l)

Working Load (kPa)					180 kPa			300 kPa			506 kPa		
Series (k&l)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
(k)	1	0	-	180	-	.026	.026	-	-	-	-	-	-
	2	3.00	3.00	506	.003	.022	.025	-	-	-	0.008	0.059	0.067
	3	9.00	9.00	506	.006	.016	.022	-	-	-	0.015	0.042	0.057
(l)	1	0	0	180	-	.026	.026	-	-	-	-	-	-
	2	3.00	3.00	506	.002	.023	.025	-	-	-	0.005	0.059	0.064
	3	9.00	9.00	506	.005	.016	.021	-	-	-	0.012	0.042	0.054

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.25	15000	0.4	0.43
35000	0.4	15000	0.4	0.43

Table (4-113) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XV - Series a)(Group X V- Series b)

Working Load (kPa)					300 kPa			400 kPa			506 kPa		
Series (a&b)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
(a)	1	0	-	817	-	.088	.088	-	-	-	-	-	-
	2	3.00	1.00	2445	.006	0.079	.085	.009	.0103	.112	.01	.129	.139
	3	6.00	2.00	2445	.012	.069	.081	.015	.092	.107	.02	.114	.134
	4	9.00	3.00	2445	.016	.063	.079	.021	.083	.104	.027	.103	.130
(b)	1	0	0	817	-	.088	.088	-	-	-	-	-	-
	2	3.00	1.00	2445	.01	.079	.089	.0103	.104	.117	.017	.130	.147
	3	6.00	2.00	2445	.017	.070	.087	.022	.092	.114	.028	.115	.143
	4	9.00	3.00	2445	.021	.063	.084	.028	.083	.111	.035	.104	.139

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.4	25000	0.2	0.71
35000	0.25	25000	0.2	0.71

Table (4-114) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m (Group XV - Series c)(Group X V- Series d)

Working Load (kPa)					300 kPa			400 kPa			506 kPa		
Series (c&d)	Test No	H (m)	H/B	q_{ut} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
(c)	1	0	-	817	-	.067	.067	-	-	-	-	-	-
	2	3.00	1.00	2445	.001	.064	.065	.013	.081	.094	.017	..101	.118
	3	6.00	2.00	2445	.003	.058	.061	.023	.070	.093	.028	.088	.116
	4	9.00	3.00	2445	.006	.052	.058	.028	.062	.090	.036	.077	.113
(d)	1	0	0	817	-	.067	.067	-	-	-	-	-	-
	2	3.00	1.00	2445	.001	.062	.063	.008	.081	.089	.011	.101	.112
	3	6.00	2.00	2445	.005	.054	.059	.016	.071	.087	.021	.088	.109
	4	9.00	3.00	2445	.008	.047	.055	.022	.062	.084	.027	.078	.105

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.25	25000	0.4	0.71
35000	0.40	25000	0.4	0.71

Table (4-115) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group XV - Series e)(Group XV - Series f)

Working Load (kPa)					180 kPa			300 kPa			506 kPa		
Series (e & f)	Test No	H (m)	H/B	q_{kz} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
(e)	1	0	-	600	-	.062	.062	-	-	-	-	-	-
	2	3.00	1.5	1013	.005	.054	.059	-	-	-	.008	.089	.097
	3	9.00	4.5	1013	.012	.043	.055	-	-	-	.022	.069	.091
(f)	1	0	-	600	-	.062	.062	-	-	-	-	-	-
	2	3.00	1.5	1013	.007	.054	.061	-	-	-	.014	.089	.103
	3	9.00	4.5	1013	.016	.043	.059	-	-	-	.026	.070	.096

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.4	25000	0.2	0.71
35000	0.25	25000	0.2	0.71

Table (4-116) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=2.00m (Group XV - Series g)(Group XV - Series h)

Working Load (kPa)					300 kPa			400 kPa			506 kPa		
Series (g & h	Test No	H (m)	H/B	q_{kx} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
(g)	1	0	-	600	-	.047	.047	-	-	-	-	-	-
	2	3.00	1.5	1013	.004	.042	.046	-	-	-	.014	.069	.083
	3	9.00	4.5	1013	.005	.040	.045	-	-	-	.026	.053	.079
(h)	1	0	-	600	-	.047	.047	-	-	-	-	-	-
	2	3.00	1.5	1013	.004	.041	.045	-	-	-	.009	.069	.078
	3	9.00	4.5	1013	.004	.039	.043	-	-	-	.021	.053	.074

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.25	25000	0.4	0.71
35000	0.4	25000	0.4	0.71

Table (4-117) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group XV - Series I)(Group XV - Series J)

Working Load (kPa)					300 kPa			400 kPa			506 kPa		
Series (i&j)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
(i)	1	0	-	300	-	.025	.025	-	-	-	-	-	-
	2	3.00	3.00	506	.002	.022	.024	-	-	-	0.006	0.036	0.042
	3	9.00	9.00	506	.003	.020	.023	-	-	-	0.012	0.027	0.039
(j)	1	0	0	300		.025	.025	-	-	-	-	-	-
	2	3.00	3.00	506	.001	.022	.023	-	-	-	0.009	0.036	0.045
	3	9.00	9.00	506	.006	.016	.022	-	-	-	0.015	0.027	0.042

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.4	25000	0.4	0.71
35000	0.25	25000	0.4	0.71

Table (4-118) Test Results: Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit B=1.00m (Group XV - Series k)(Group XV - Series l)

Working Load (kPa)					300 kPa			400 kPa			506 kPa		
Series (k&l)	Test No	H (m)	H/B	q_{ult} kN/m^2	Settlement of layers (m)			Settlement of layers (m)			Settlement of layers (m)		
					upper	lower	total	upper	lower	total	upper	lower	total
(k)	1	0	-	300	-	.032	.032	-	-	-	-	-	-
	2	3.00	3.00	506	.003	.028	.031	-	-	-	0.008	0.046	0.054
	3	9.00	9.00	506	.008	.0216	.030	-	-	-	0.016	0.035	0.051
(l)	1	0	0	300		.032	.032	-	-	-	-	-	-
	2	3.00	3.00	506	.003	.028	.031	-	-	-	0.005	0.046	0.051
	3	9.00	9.00	506	.007	.022	.029	-	-	-	0.012	0.035	0.047

Soil Properties:

E_1 kN/m^2	μ_1	E_2 kN/m^2	μ_2	E_2/E_1
35000	0.25	25000	0.2	0.71
35000	0.4	25000	0.2	0.71

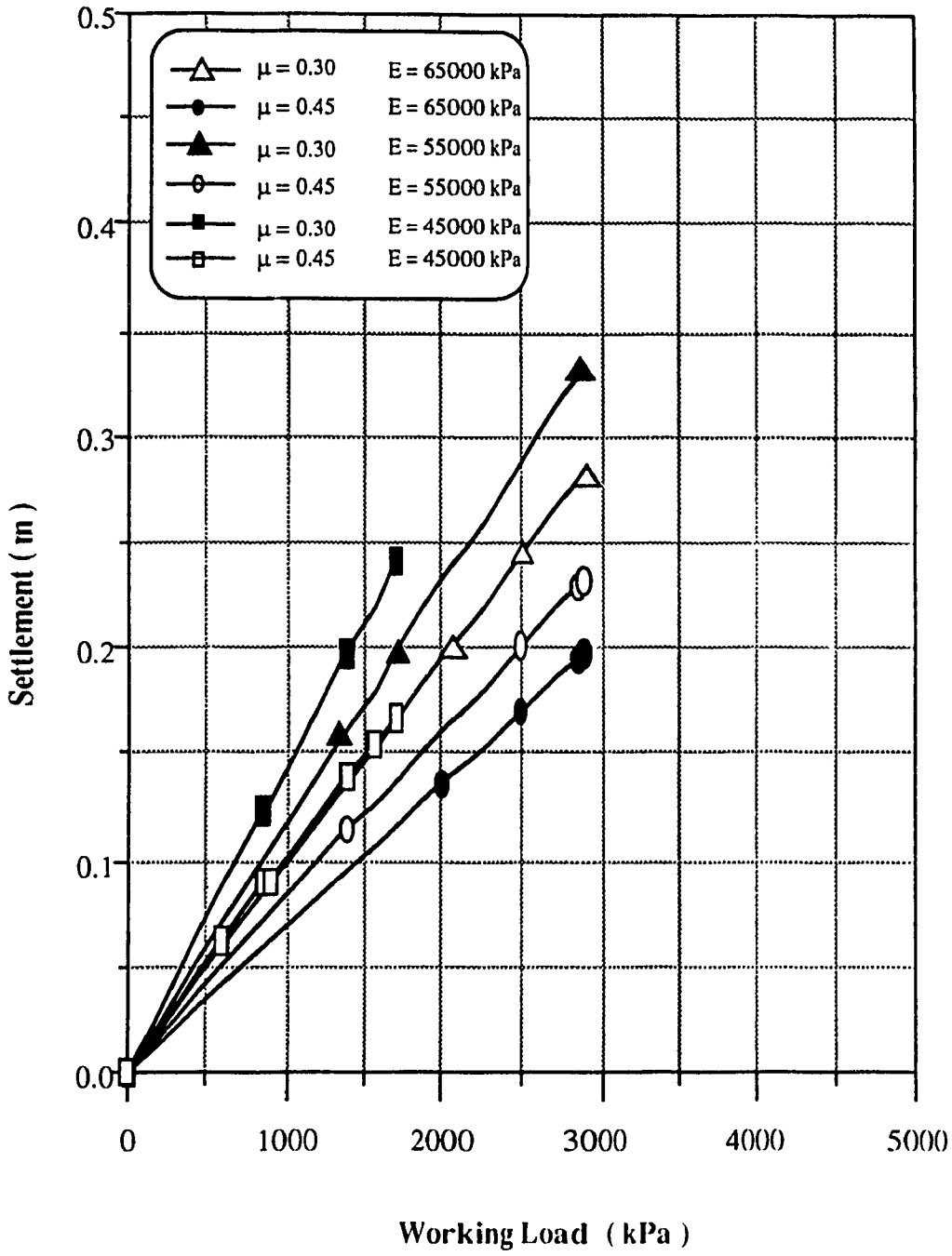


Figure (4-1) Test Results Load versus settlement of Surface Strip Footing on Homogeneous Dense Sand [B = 3.00 m]

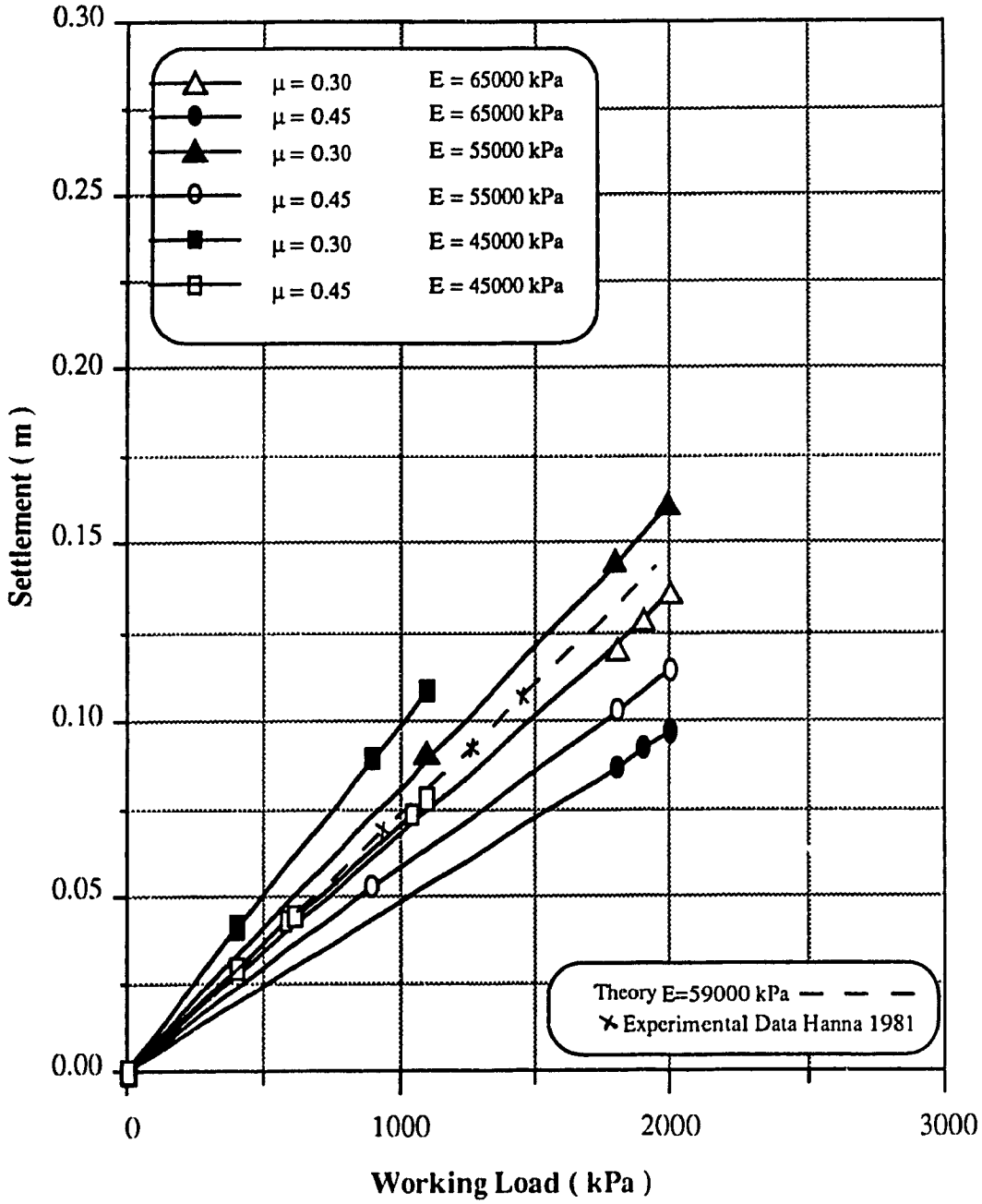


Figure (4-2) Test Results Load versus settlement of Surface strip Footing on Homogenus Dense Sand [B = 2.00 m]

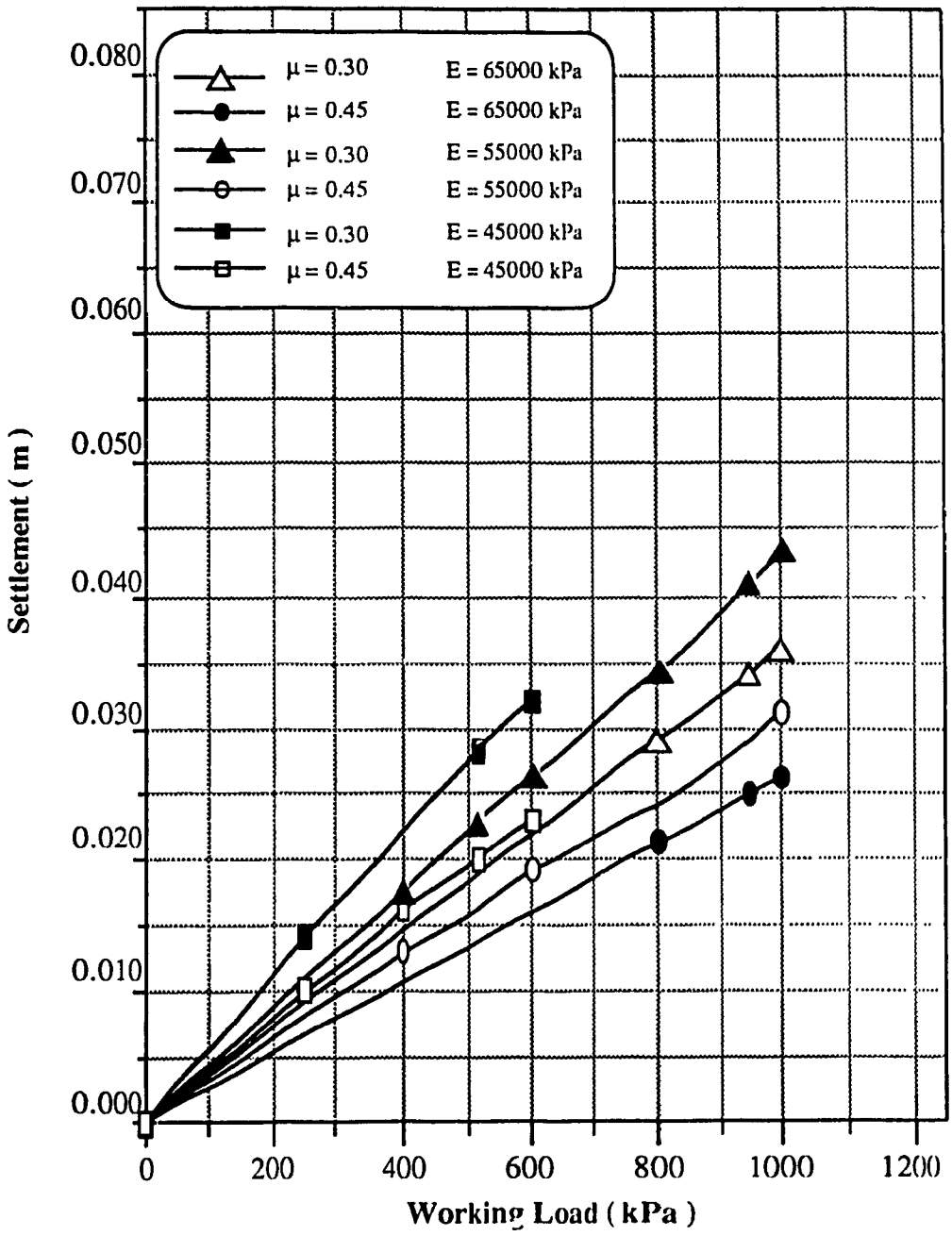


Figure (4-3) Test Results Loac Versus Settlement of Surface Strip Footing on Homogeneous Dense Sand [B =1.00 m]

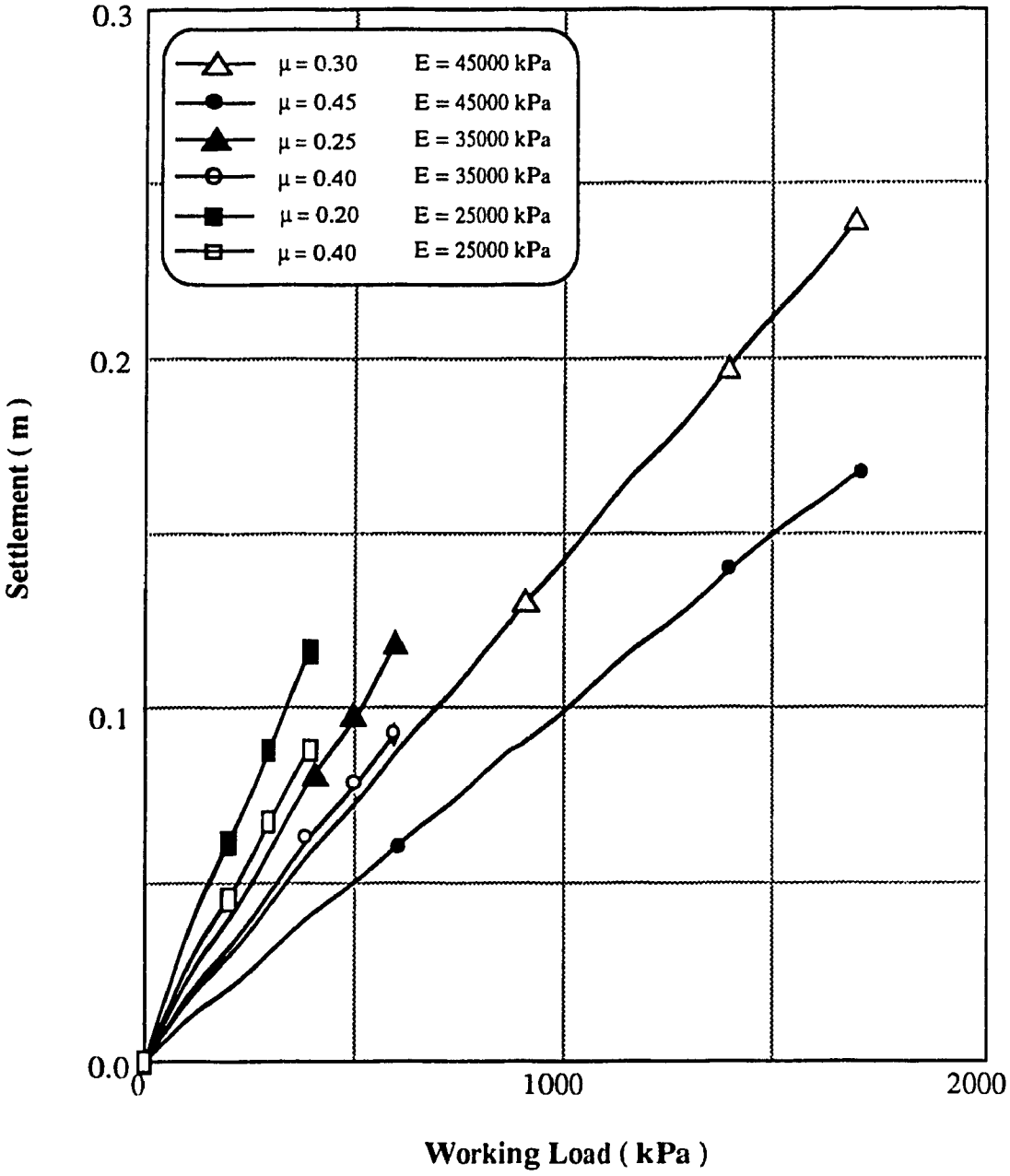


Figure (4-4) Test Results Load versus settlement of Surface Strip Footing on HomogenusMedium sand [B = 3.00 m]

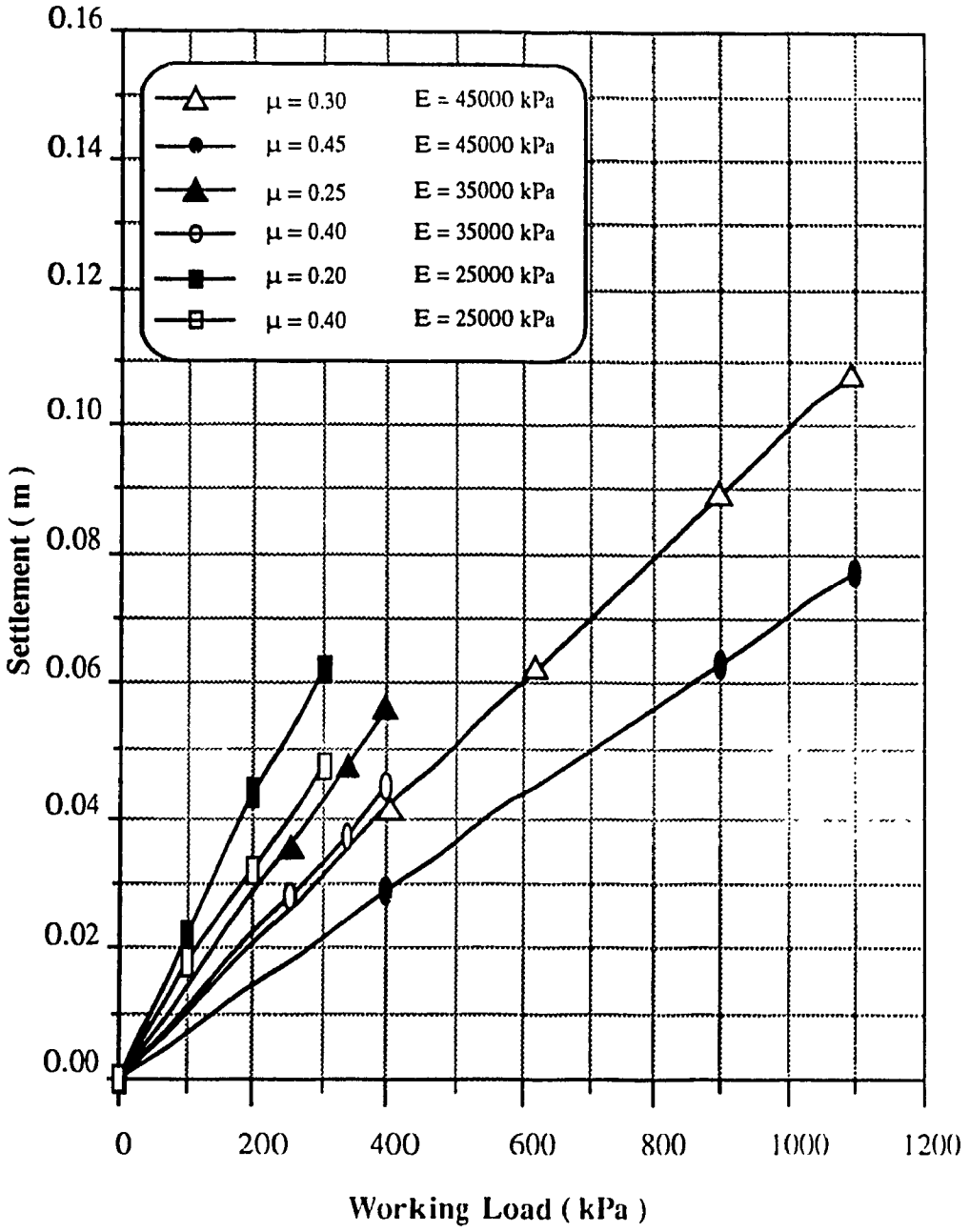


Figure (4-5) Test Results Load Versus Settltment of Surface Strip Footing on Homogeneous Medium Sand [B =2.00 m]

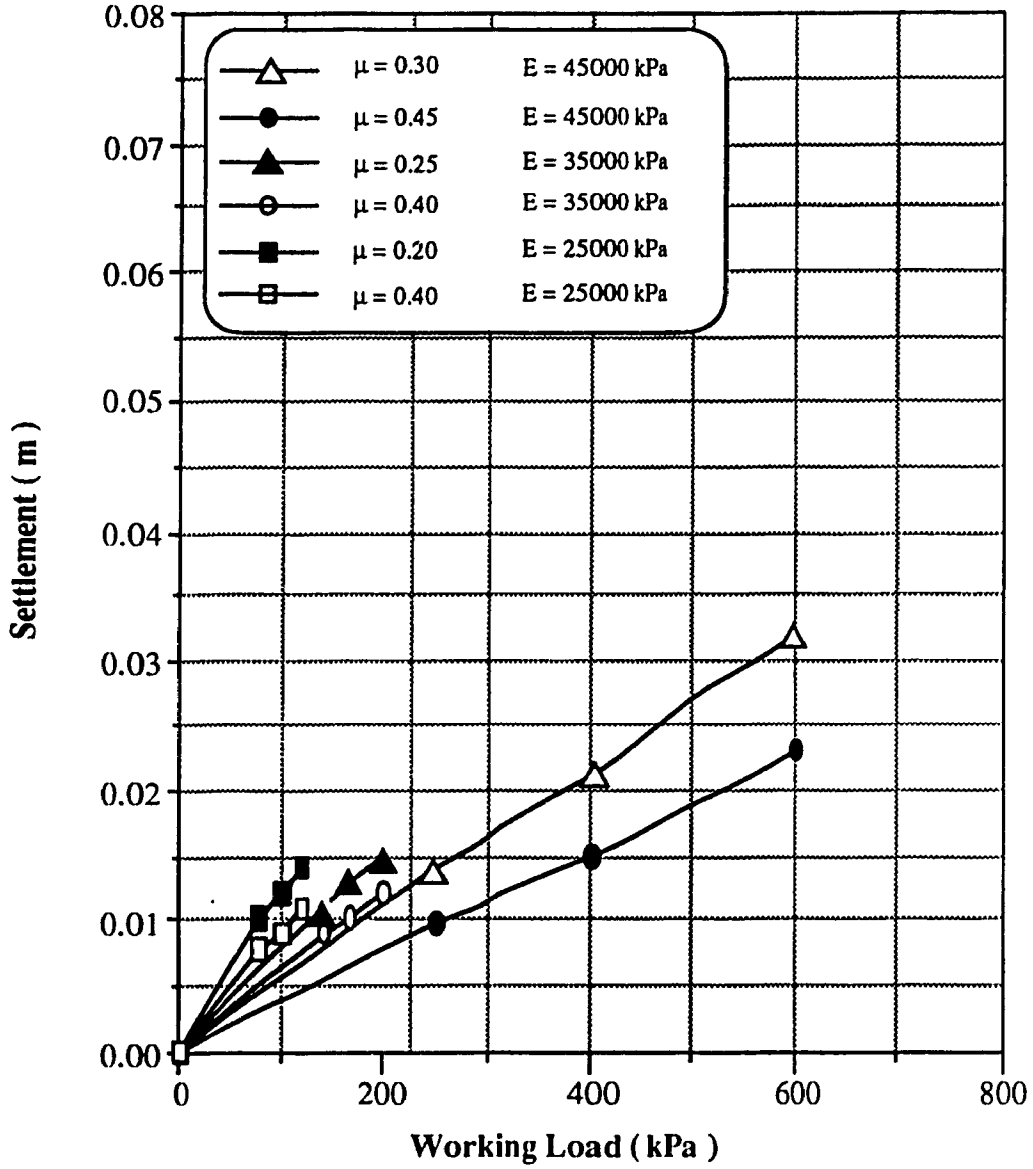


Figure (4-6) Test Results Load Versus Settlement of Surface Strip Footing on Homogeneous Medium Sand [B =1.00 m]

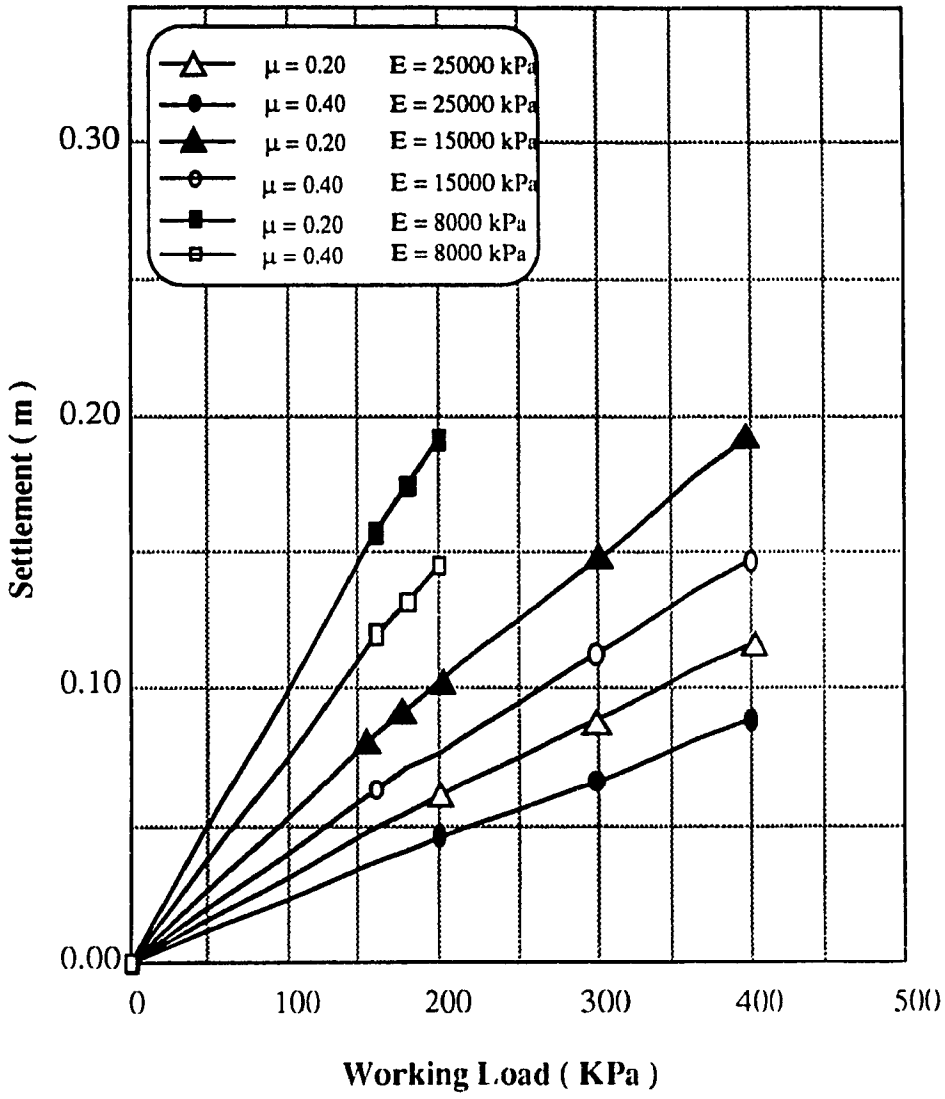


Figure (4-7) Test ResultsLoad Versus Settlement of Surface Strip Footing on Homogeneous Loose Sand [B = 3.00 m]

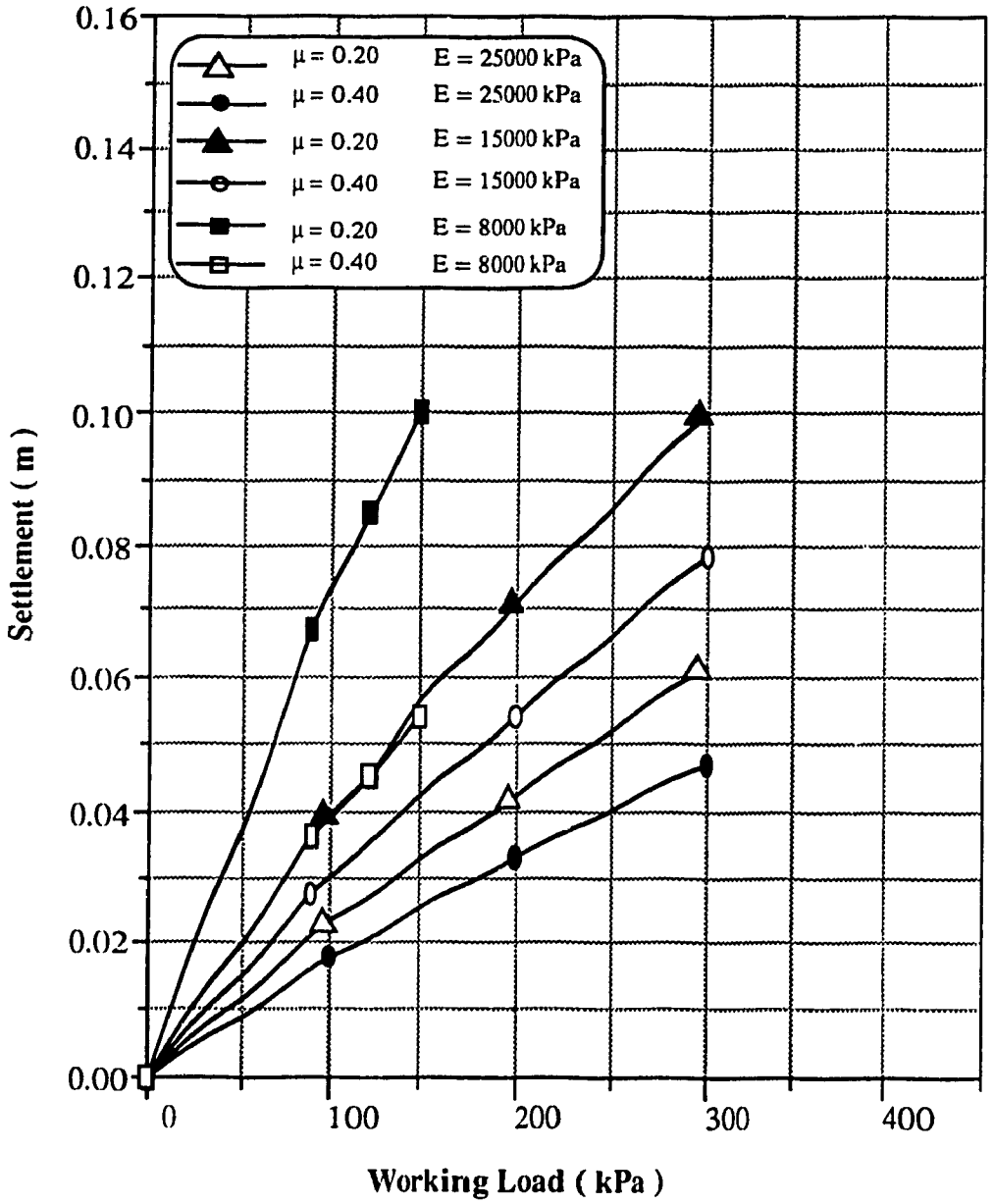


Figure (4-8) Test Results Load Versus Settlement of Surface Strip Footing on Homogeneous Loose Sand [B = 2.00 m]

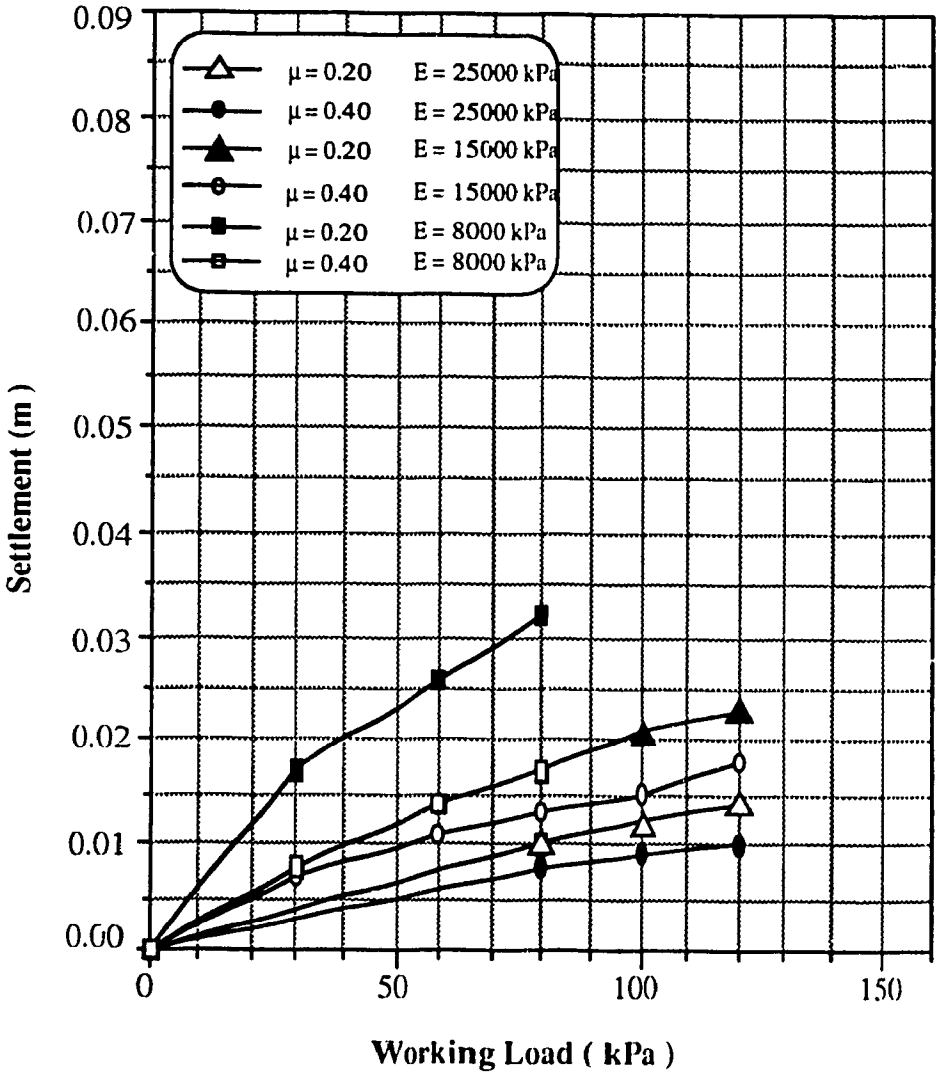


Figure (4-9) Test Results Load Versus Settlement of Surface Strip Footing on Homogeneous Loose Sand [B =1.00 m]

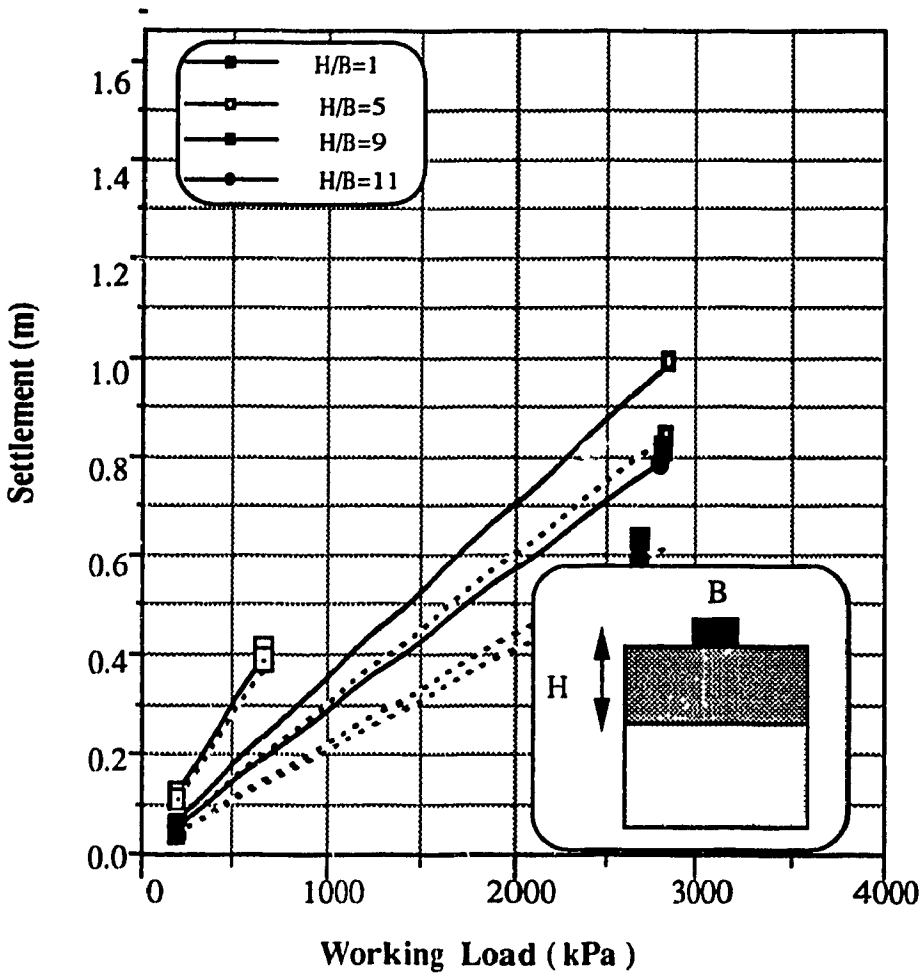
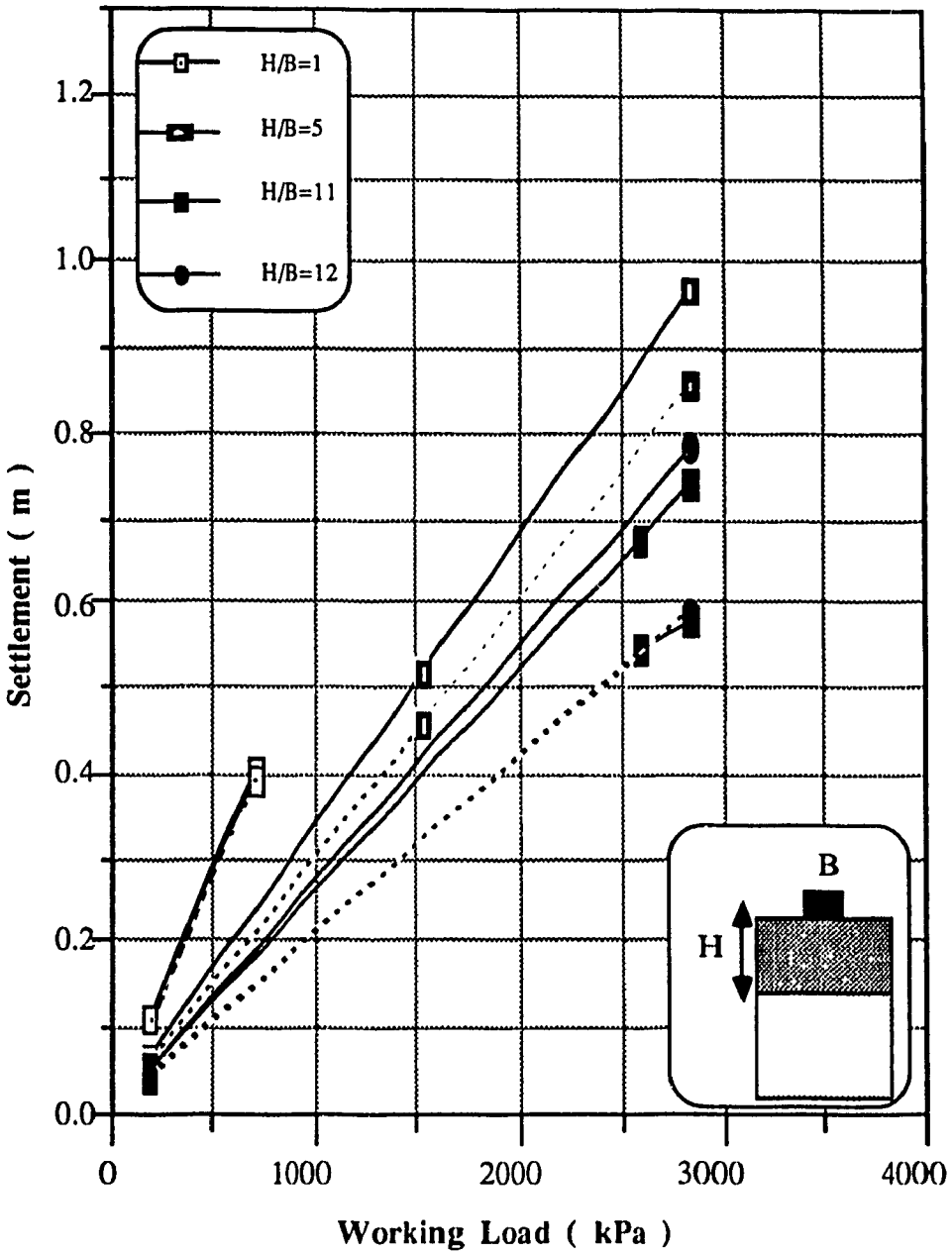
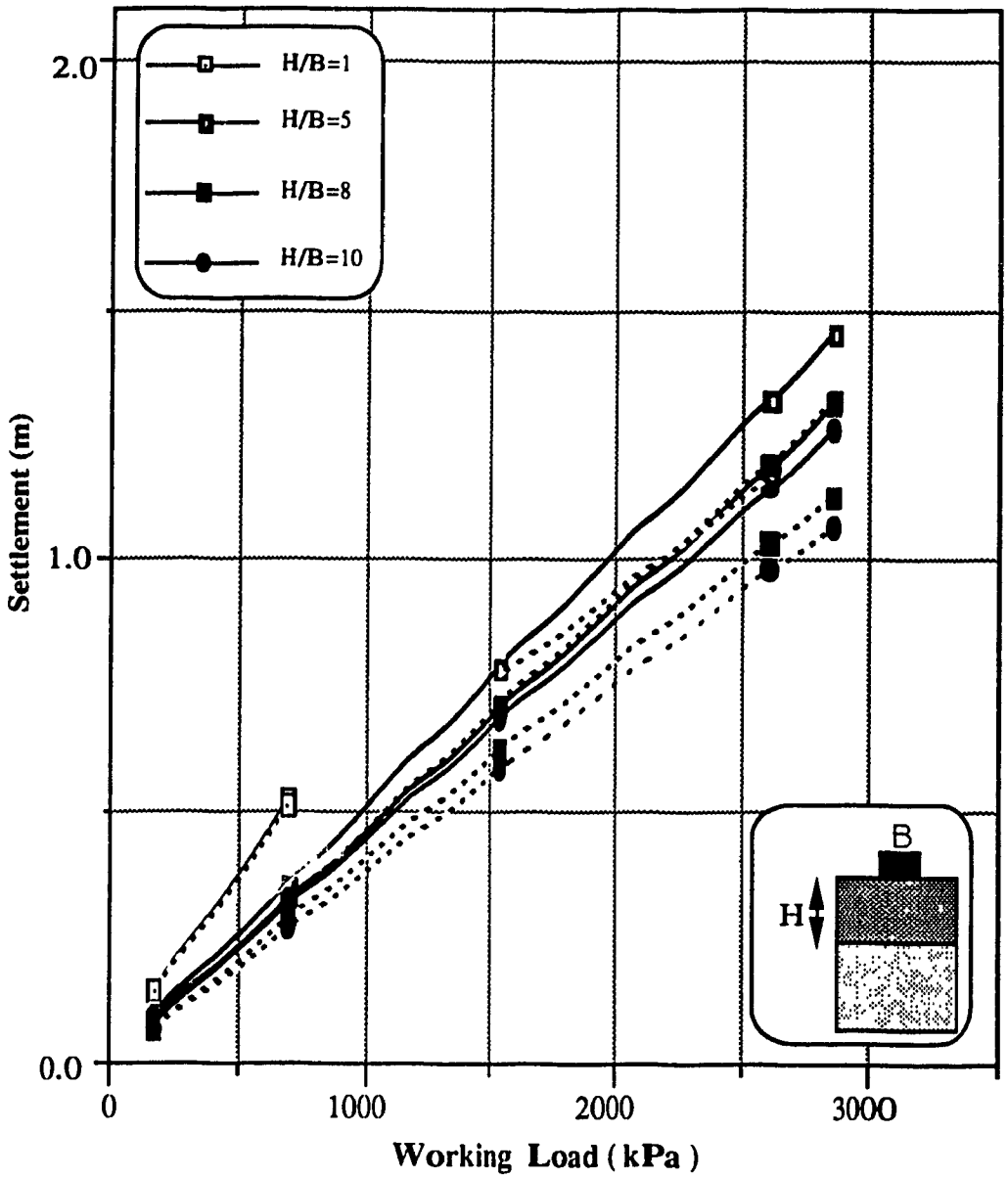


Figure (4-10) Test Results Load Versus Settlement of Surface StripFooting on Dense Sand Overlying aWeak Deposit [B =3.00 m]



(GroupVII-Seriesd)

Figure (4-11) Test Results Load Versus Settement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit [B= 3.00 m]



(GroupVII-Seriesb)

Figure (4-12) Test Results Load Versus Settlement of Surface stripFooting on a dense Sand Overlying a Weak Deposit [3 .00 m]

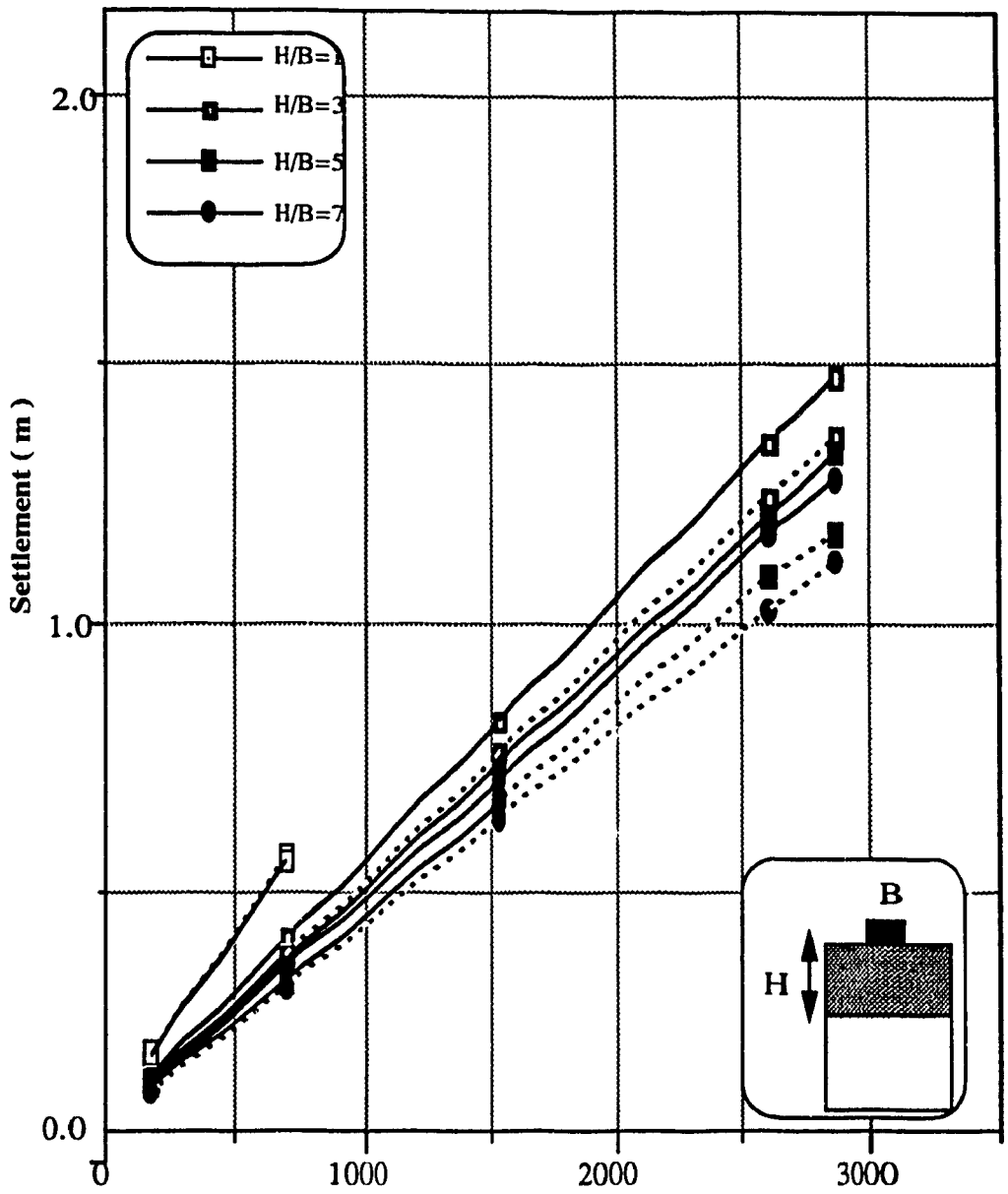
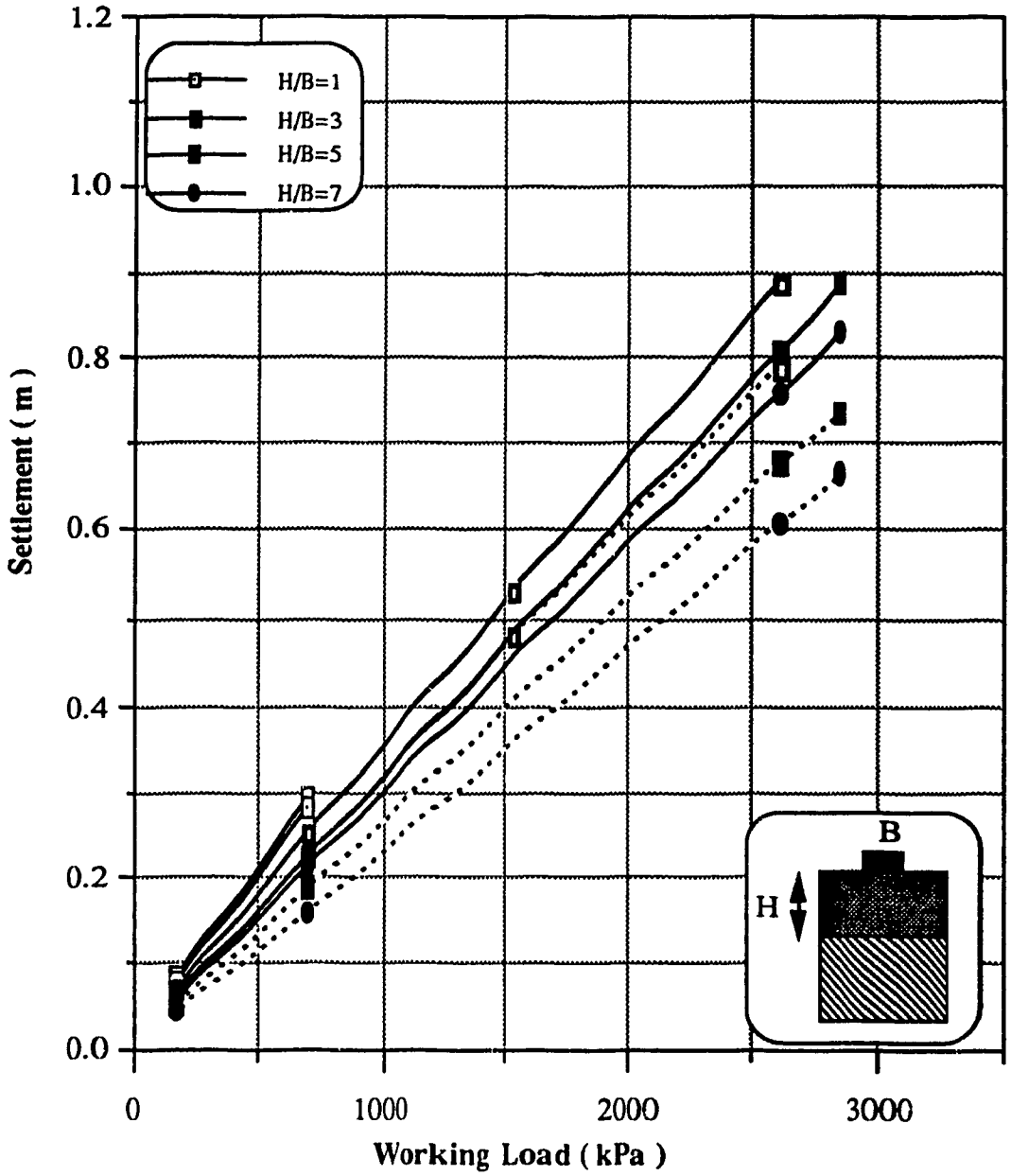


Figure (4-13) Test Results Load Versus Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit [B = 3.00 m]



(GroupVIII-Seriesa)

Figure (4-14) Test Results Load Versus Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit [B = 3.00 m]

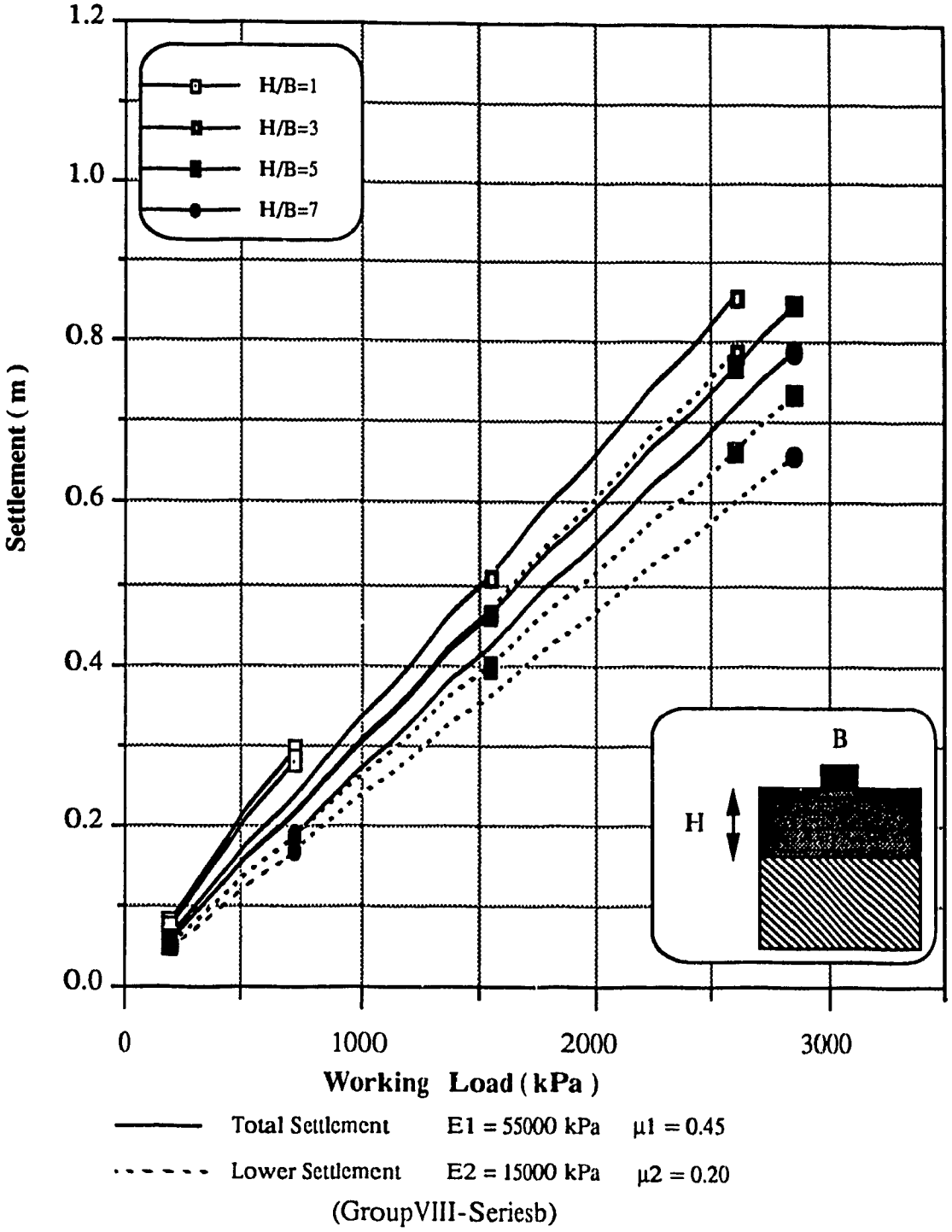


Figure (4-15) Test ResultsLoad Versus Settlement
of Surface strip Footing on a Dense sand
Overlying a weak Deposit [B = 3.00 m]

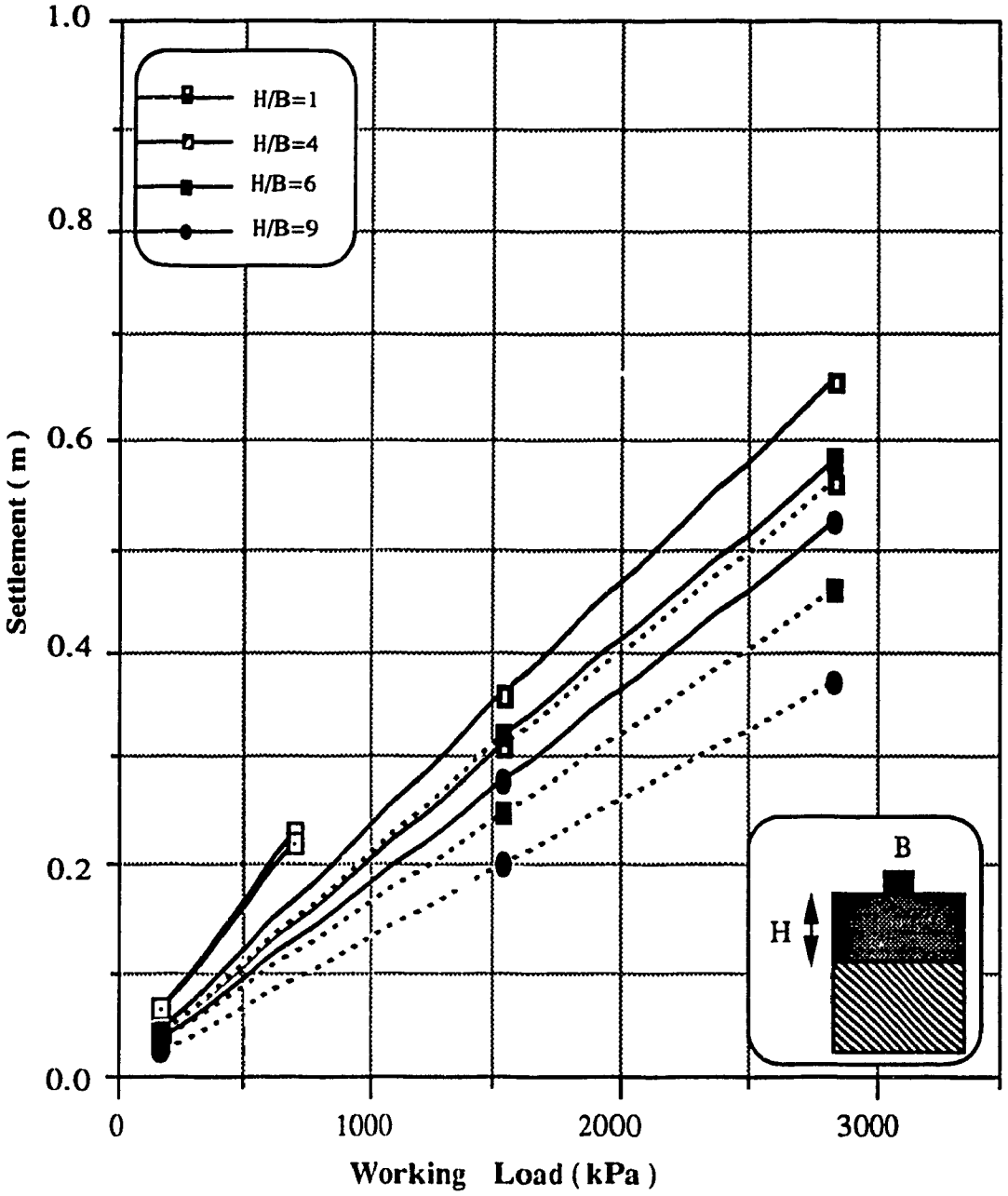
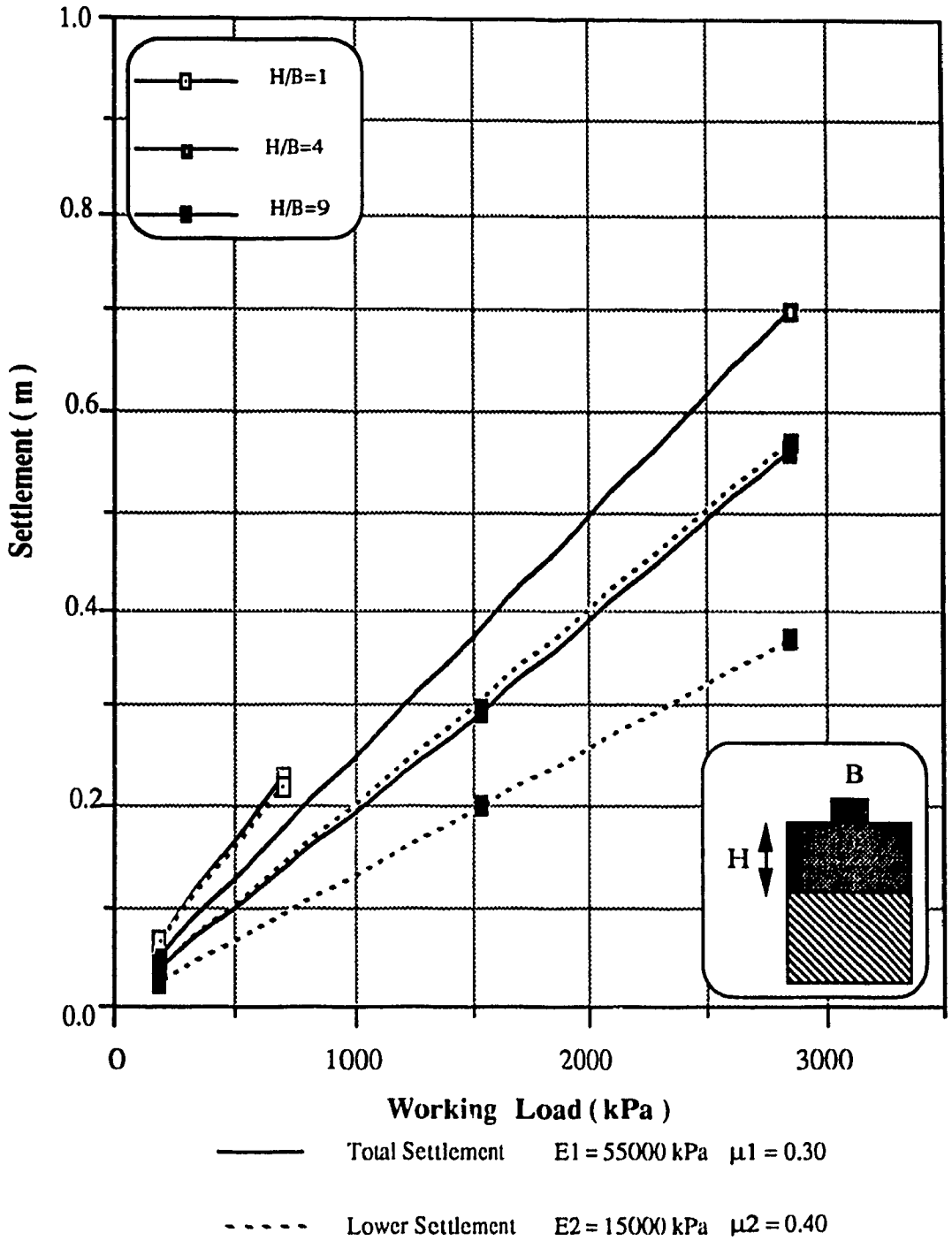


Figure (4-16) Test results Load Versus Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit [B = 3.00 m]



(GroupVIII-Seriesc)

Figure (4-17) Test Results Load Versus Settlement of surface strip Footing on a Dense Sand Overlying a Weak Deposite [B = 3.00 m]

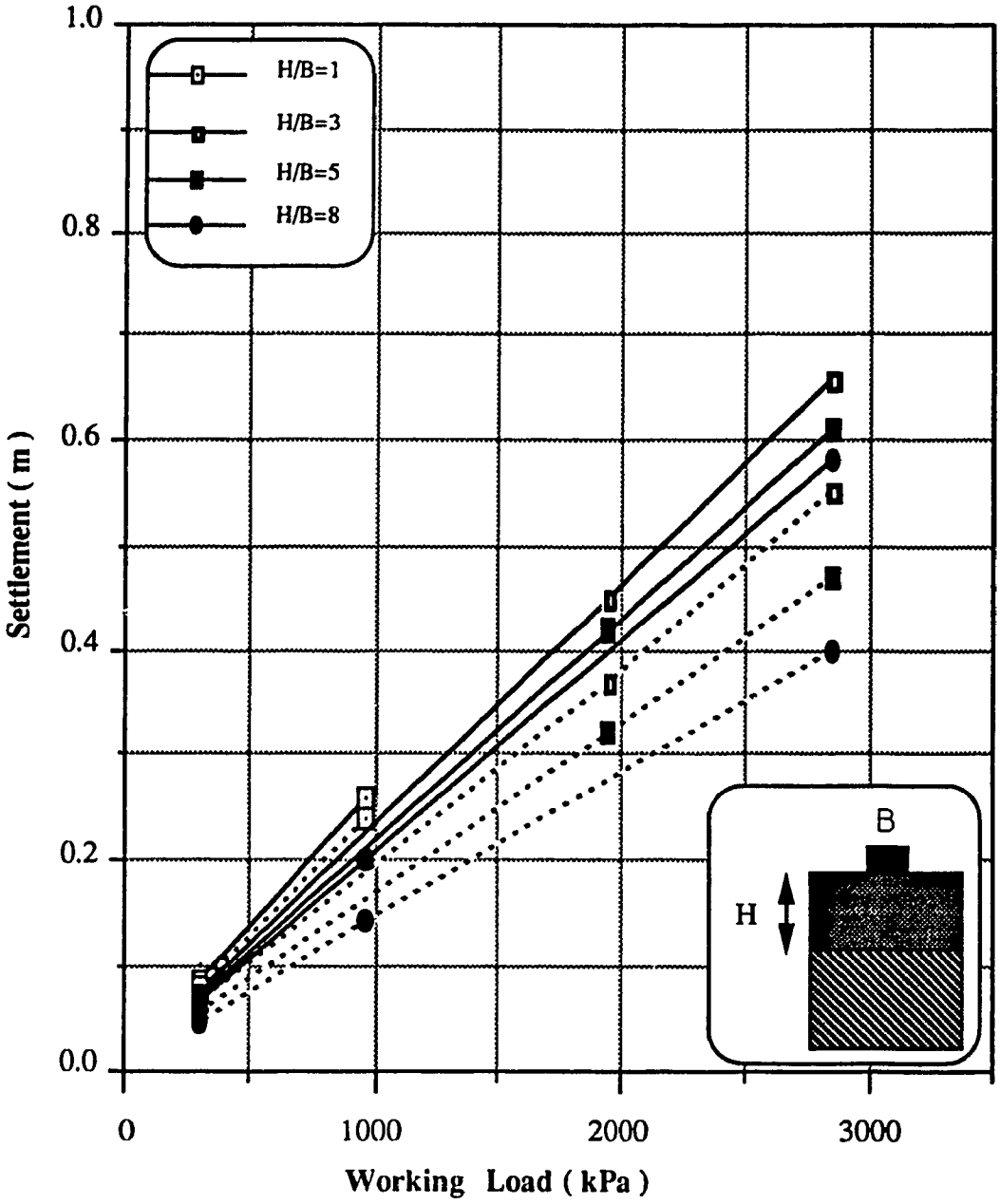
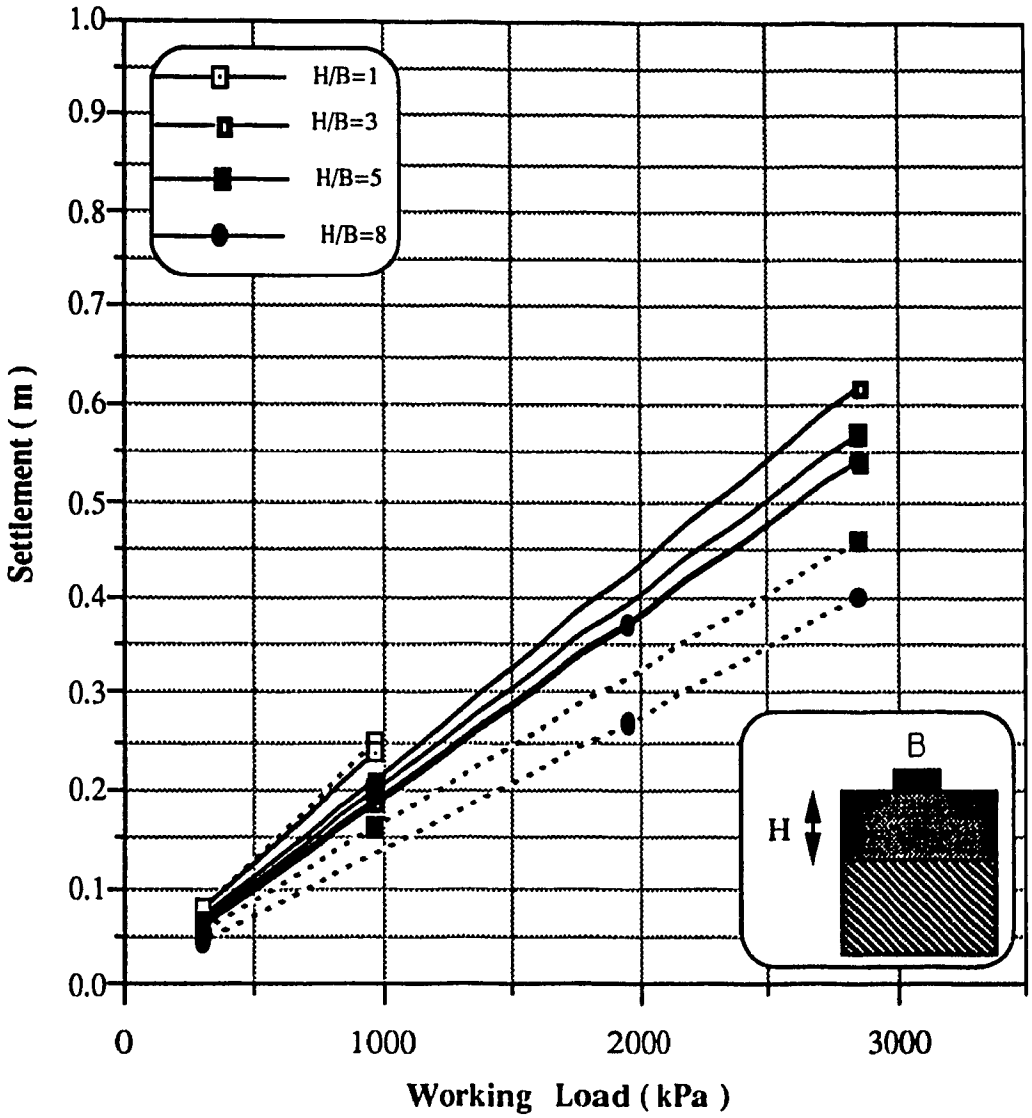


Figure (4-18) Test Results Load Versus Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak deposite [B = 3.00 m]



——— Total Settlement E1 = 55000 kPa μ1 = 0.45

- - - - Lower Settlement E2 = 25000 kPa μ2 = 0.20

(GroupIX-Seriesd)

Figure (4-19) Test Results Load Versus Settlement of Surface Strip Footing on a Dense Sand Overlying a Weake Deposit [B=3.00m]

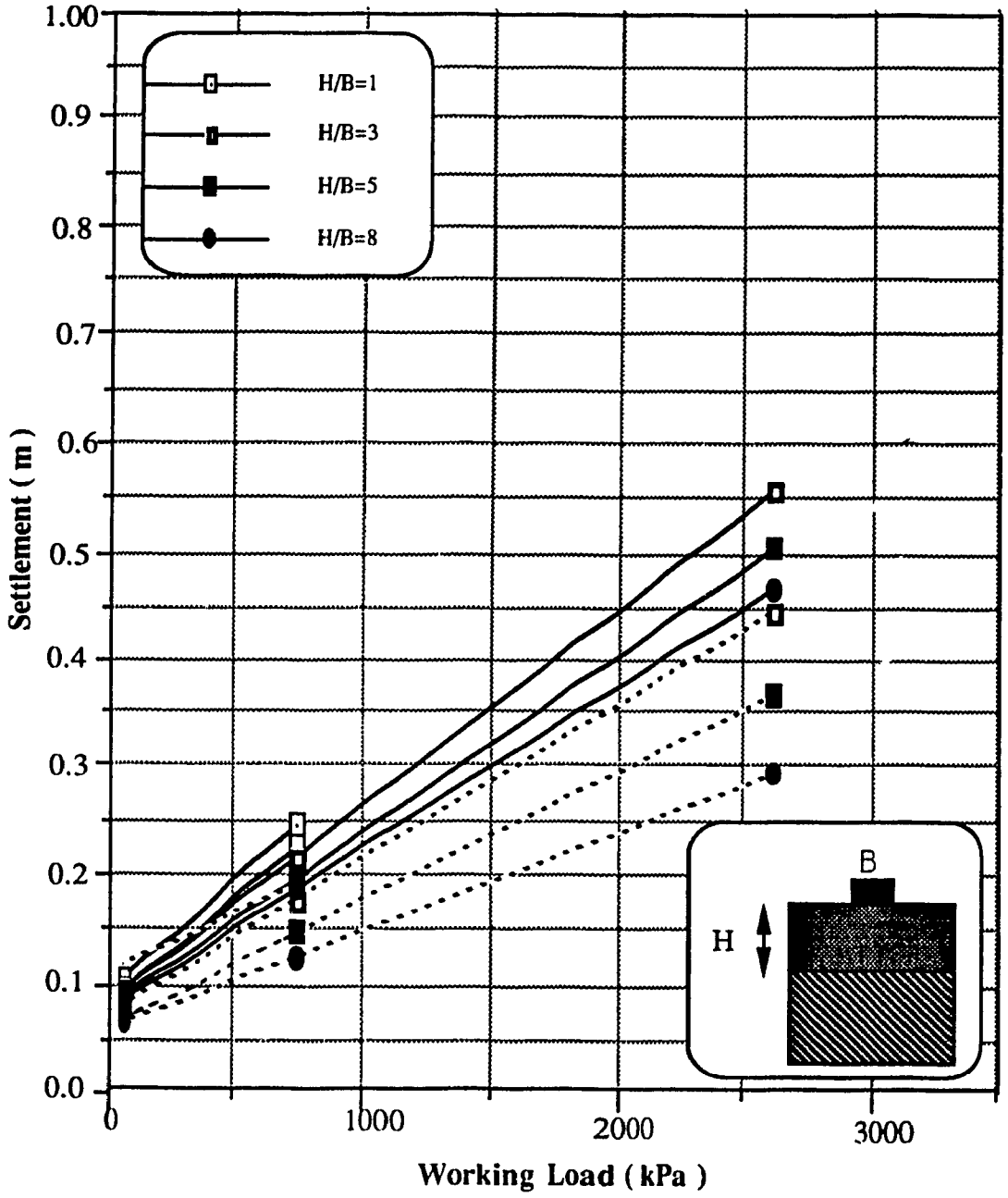
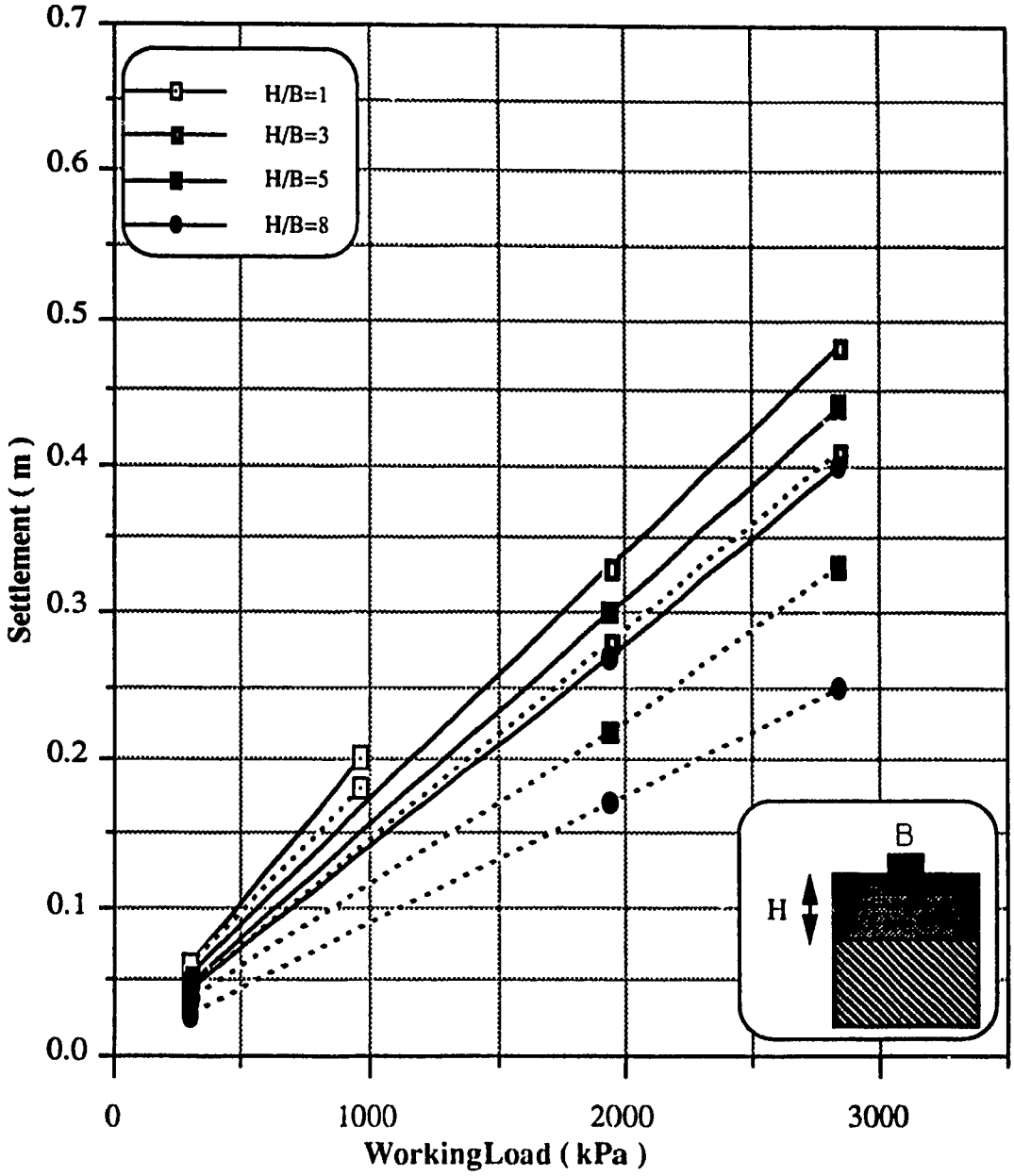


Figure (4-20) Test Results Load Versus Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak Deposit [B = 3.00 m]



(GroupIX-Seriesb)

Figure (4-21) Test Results Load Versus Settlement of Surface Strip Footing on a Dense Sand Overlying a Weak deposite [B = 3.00 m]

4.2.1 Effect of Modulus of Elasticity E:

In the case of strip footing on homogeneous sands, the deduced settlements S decreases due to an increase of the modulus of elasticity E, (see tables 4-2 to 4-10 and figures 4-1 to 4-9). Figure 4-22 shows the predicted settlements versus modulus of elasticity for different loading conditions. From this figure it can be noted that the relationship of S/B ratio versus E is an independent of the footing width B. Furthermore, the results of the present investigation agree well with the results of the theory of elasticity, Das (1990). This finding should develop confidence in the theoretical model used in this investigation. For the case of strip footing on a dense sand layer overlying a weak deposit, as shown in tables (4-11) to (4-118) and demonstrated in figures (4-10) to (4-21), the deduced settlement decreases due to an increase of either of modulus of elasticity E_1 and E_2 for the upper and lower layers respectively, under the same loading condition and the same thickness of the upper layer below the footing base.

4.2.2 Effect of Possion's Ratio μ

In case of strip footings on homogeneous sands, the deduced settlement decreases slightly due to an increase of the Possion's ratio μ, under the same loading condition. It is of interest to note that for a modulus of elasticity E = 65000 kN/m^2 (dense sand), the settlement decreases by an amount of about 30% by increasing Possion's ratio from 0.3 to 0.45, while for E = 25000 kN/m^2, (medium sand), the settlement decreases by an amount of about 20% by increasing Possion's ratio from 0.2 to 0.4. (See tables 4-2 to 4-10 and figures 4-1 to 4-10). For sand of modulus of elasticity E = 25000 kN/m^2 or lower, the decrease of settlement remains unchanged at about 20%.

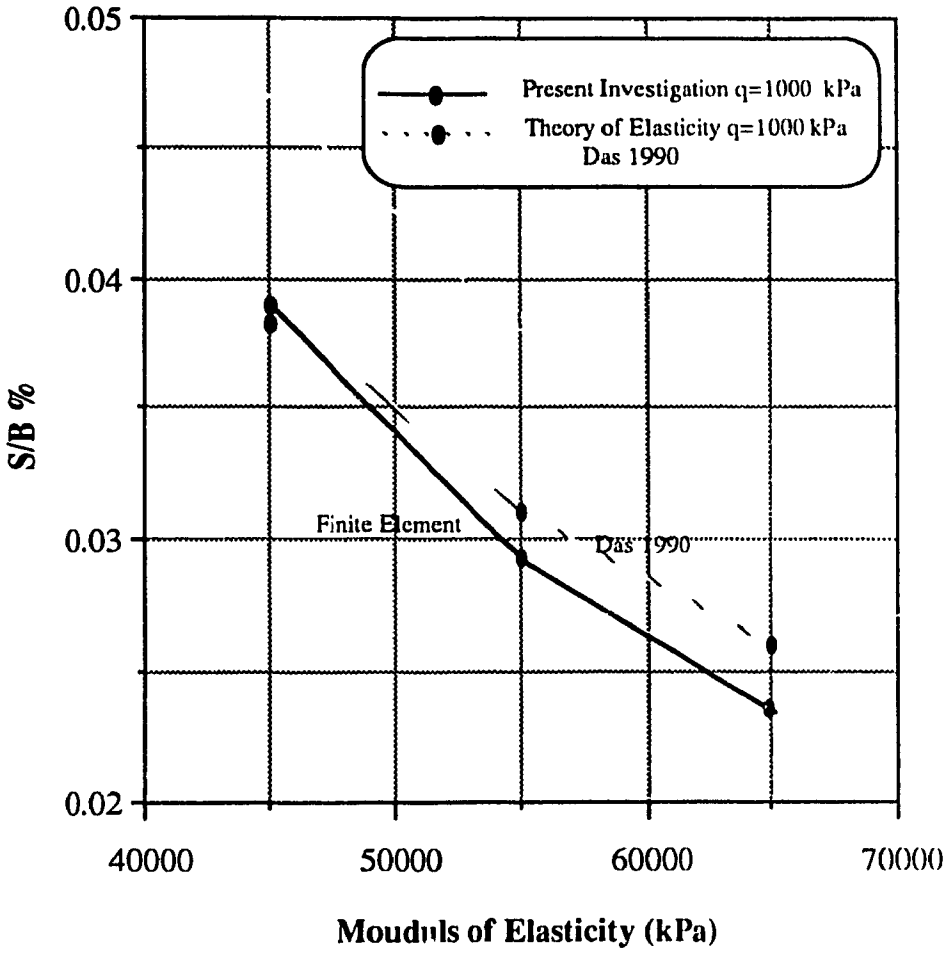


Figure (4-22) Mouduls of Elasticity Versus Settlement of strip Footing on Homogeneous Dense sand B = 3.00 m

In case of strip footing on a dense sand layer overlying a weak deposit, the effect of Possion's ratio for both layers is quite similar to the case of homogeneous sand which contributes to the total settlement of the sand layers.

4.2.3 Effect of the Thickness of Upper Layer H:

In this investigation the strength of upper layer has been always higher than the one for the lower layer. Referring to (Tables 4-11 to 4-118 and Figures 4-10 to 4-21), it can be reported that the deduced settlement decreases by an increase of the thickness of the upper layer H.

From these tables and figures, it can be noted that the influence of the lower layer on the deduced settlement remains predominant at higher values of the thickness of the upper layer H.. This contradicts the information given in literature with respect to the role of the lower layer (Schmertmann 1970). This can be explained by the fact that the upper layer at a given degree of rigidity transfer the load to the lower layer causing such settlement. At a higher ratio of H/B>100, the lower layer will not contribute to the total settlement and the upper layer can be treated as homogeneous soils.

4.4.4 Effect of Width of Footing B:

The deduced settlement for footings on homogenous sand as well as on layered of sands, decreases by increasing the footing width B. See Figure 4-1 to 4-9 and 4-10 to 4-12 for homogeneous sand and layered soils, respectively.

4.3 Settlement Components

From the finite element results, the total settlement was determined as a vertical displacement immediately below the footing base and at the nodal point of the footing edges (nodal 60 and nodal 117 see Figure 3-2). The contribution of the lower layer settlement was taken as a vertical displacement of the two middle points below the edges of footing on the interface layer (nodal 6 and 39, Figure 3-1). The contribution of the upper layer to the total settlement was basically the total settlement of the footing minus the contribution of lower layer settlement which were described above.

Figure 4-23 shows these settlement components S_1 and S_2 for the upper and lower layers respectively, together with the total settlement of the footing. It is of interest to note that the settlement of the lower layer has initial value equivalent to the settlement of this footing on homogeneous lower layer at H/B = 0. This component, S_2, decreases gradually due to the increase of the thickness of the upper layer H up to minimum value of a zero obtained by simple interpolation from the same. In Figure 4-23 this minimum value is reached at an approximate value of H/B = 100. This leads to the conclusion that the contribution of the lower layer remains significant and effective in estimating the total settlement of the footing. This, of course, contradicts the existing knowledge in literature and questions design theories available in estimating the settlement of foundations. While the contributions of lower layer decreases by increasing the thickness of the upper layer, the contribution of the upper layer to the total settlement increases from zero value at H/B = 0 to the maximum value attained at approximate value H/B = 100 and equivalent to the total settlement of the footing. It should be made clear that for ratio H/B $\leq$ 100 the system behaves as layered system and the contribution of lower layer remains significant and the total settlement is made of two components S_1 and S_2 for the upper and lower layers, respectively.

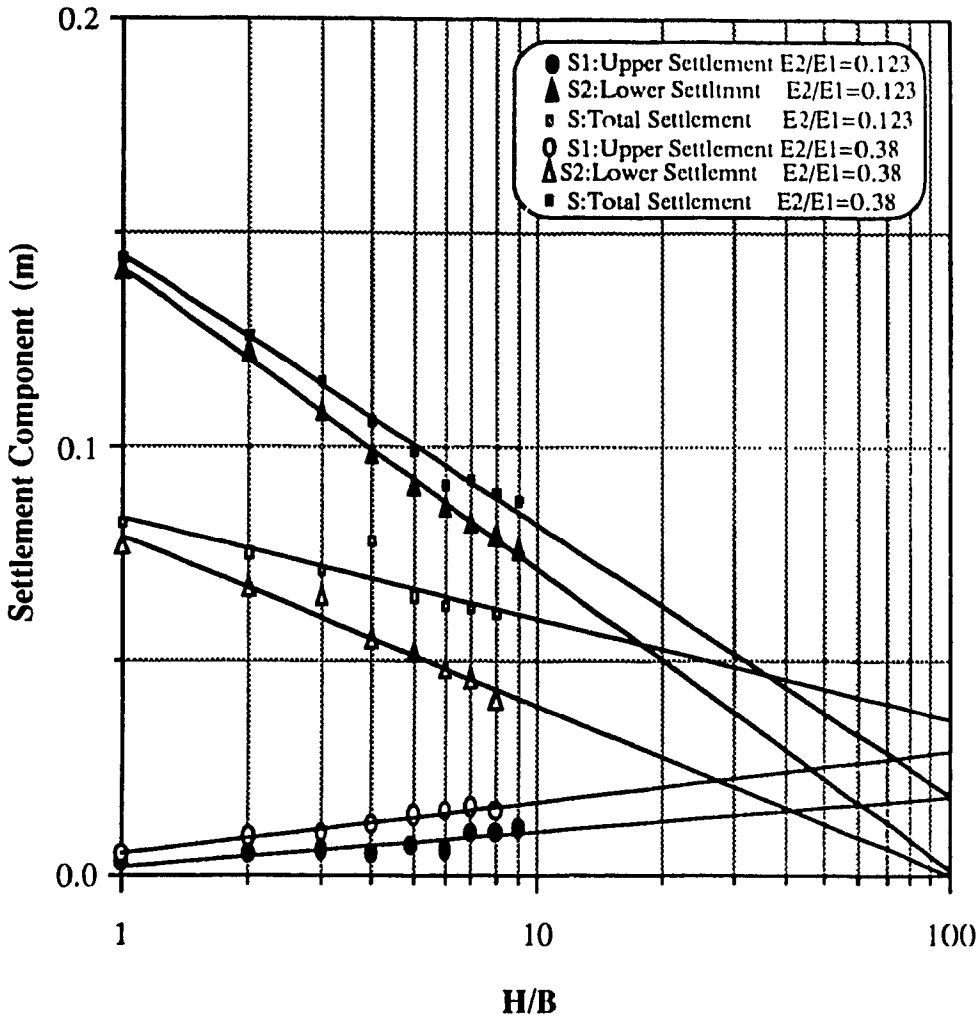


Figure (4-23) Settlement ComponentsVersus H/B, S1,S2,Upper,Lower Layers Respectivley

Beyond the ratio H/B = 100 the total settlement shall be produced entirely by the upper layer and the system can be treated as homogeneous upper layer material. This finding can be explained that the stresses produced by the footing within the above mentioned range is taken in part by the upper layer while it functions as the rigid media to transfer this other part to the lower layer.

4.4 Design Charts

The results of the present investigation are represented in a non-dimensional form in figures 4-24, 4-25 and 4-26 In these figures the vertical axis reads the reduction in the footing's settlement as a percentage of the settlement of the homogeneous lower layer due to placing on the top a thin layer of dense sand of thickness H and modulus of elasticity E_1. The relationship is found to be linear and depends on the ratio E_2/E_1 as shown in these figures. The practicing engineers may use these charts as a guide to estimating the required thickness of the upper layer and its modulus of elasticity to reduce the settlement to a design level.

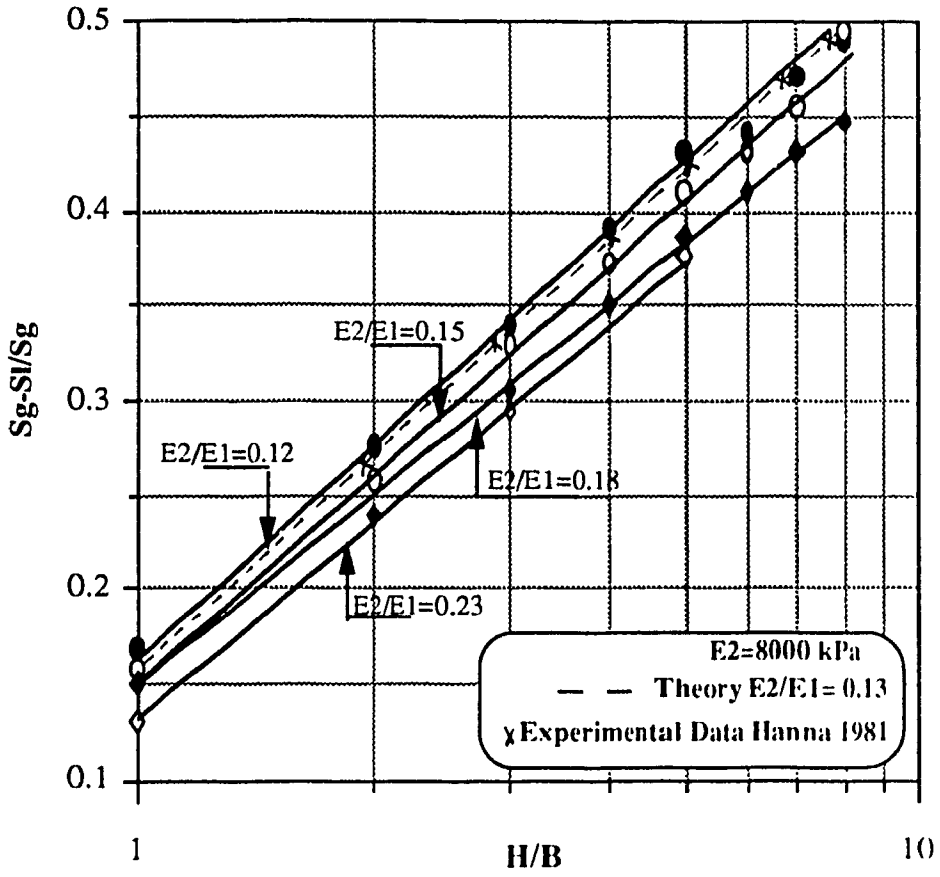


Figure (4-24) Reduction of Settlement of Strip Footing on a Dense Sand Overlying aWeak Deposit B=3.00m

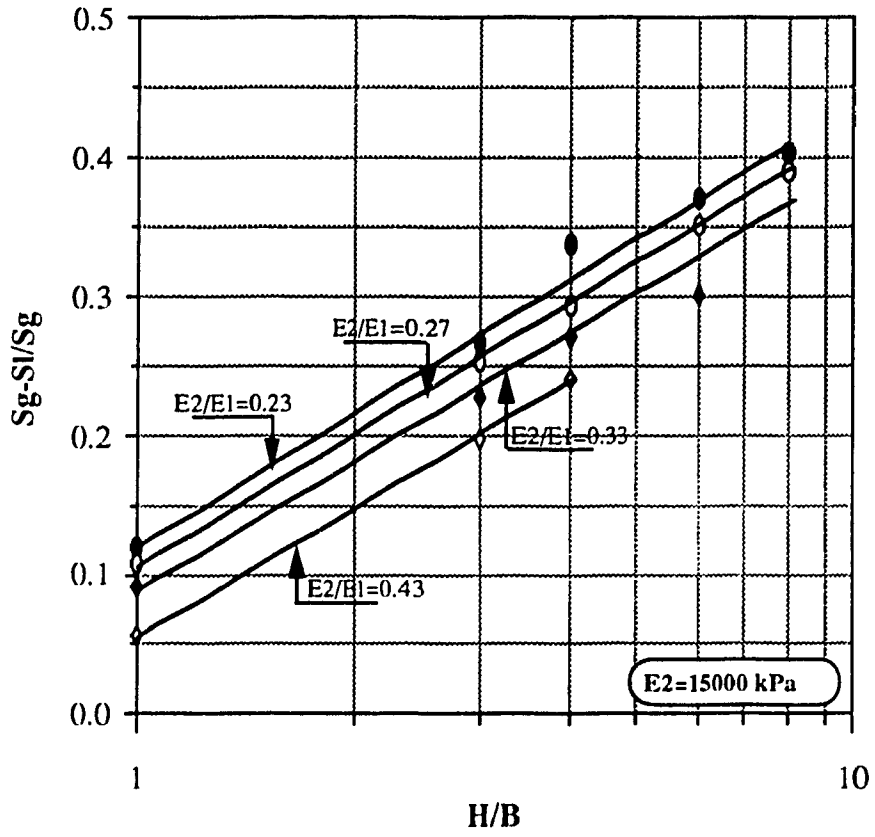


Figure (4-25) Reduction of Settlement of Strip Footing on a Dense Sand Overlying aWeak Deposit B=3.00m

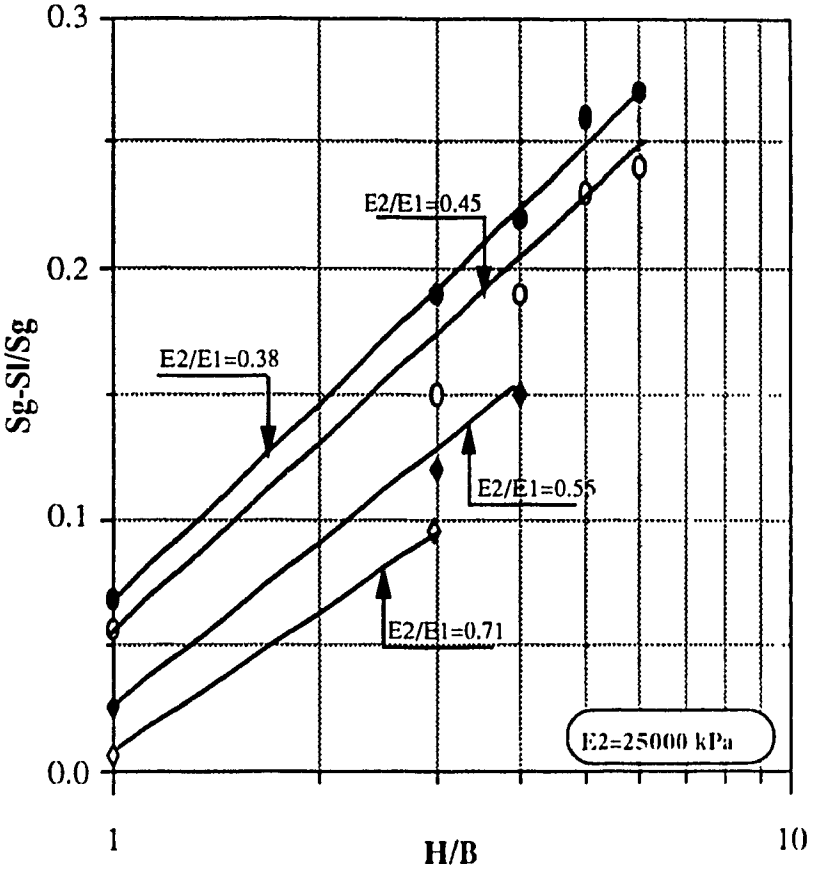


Figure (4-26) Reduction of settlement of Strip Footing on a Dense Sand Overlying a Weak Deposit B=3.00m

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Theoretical study on the determination of settlements of strip footings on a dense sand layer overlying a weak deposit was conducted, the following can be concluded.

1. finite element technique is a powerful tool in solving many foundation engineering problems.
2. for settlement analysis, the assumption of treating the soil as an elastic media is a reasonable assumption. This is based on the fact that the results of the present investigation were compared with the experimental data available in the literature, where agreement was acheived.
3. for homogeneous sand settlement of strip footing decreases due to an increase in the modulus of elasticity and decreases due to an increase of Poisson's ratio. Also, the settlement increases by increasing the foundation width under the same loading conditions.
4. For strip footing on dense sand layer overlying a weak deposit, the deduced settlement not only depends on the factors mentioned above, but also on the thickness of upper layer below the footing base.
5. Under the same conditions, by increasing the thickness of the upper layer, the settlement of the lower layer decreases from a maximum value equivalent to the value for footing on homogeneous lower layer at H = 0 to almost a zero value at H/B = 100 while the settlement of upper layer increases from zero value at H = 0 up to value equivalent for the settlement of homogeneous upper layer.

Within the range H/B > 0 to H/B = 100 the total settlement of the footing is made of two components namely, the upper and lower layer soils. This finding contradict the existing knowledge, mainly that the settlement will be entirely confined in the upper layer at H/B ≥2.

6. Design charts are presented to assist the practicing engineer in choosing the material of upper layer (thickness H and modulus of elasticity E) to be added artificially on a weak deposit in order to reduce the settlement to an allowable value which is expected to be tolerated by the proposed structure.

5.2 Recommendation for future work

1. The result of the present investigation should be examined against experimental data which allows the measurement of settlement components.
2. Although it is believed that the soil at the working load condition behaves as an elastic material, attempts should be made to use other soil models available in the literature, such as non-linear, elastic perfectly plastic, etc.
3. The contribution made in this research program should be put forward in simple formulae and/or computer package to be directly used by practicing engineers in order to determine the components as well as the total settlement of these footings.
4. The present investigation should be extended to deal with multi-layer systems or to soil with variable shear strength.

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